A REVIEW OF THE LEAF-TAILED GECKOS ENDEMIC TO EASTERN AUSTRALIA: A NEW GENUS, FOUR NEW SPECIES, AND OTHER NEW DATA

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Saltuarius gen. nov. is separated from *Phyllurus* by external and internal characters, and by karyotype. To it are assigned *S. cornutus* (Ogilby, 1892); *S. salebrosus* (Covacevich, 1975); *S. swaini* (Wells & Wellington, 1985) and *S. occultus* sp.nov. To *Phyllurus* sensu stricto are assigned *P. caudiannulatus* Covacevich, 1975; *P. platurus* (Shaw, 1790); *P. isis* ; *P. nepthys* and *P. ossa* spp. nov. The leaf-tailed geckos (*Saltuarius* spp. and *Phyllurus* spp.) are confined to narrow, isolated patches of rainforest or heathlands in coastal Australia between the McIlwraith Range, far northeastern Queensland (13°45'S, 143°19'E) and the Hawkesbury Sandstone area, near Sydney (33°55'S,151°13'E), mideastern New South Wales. Endemic species lists for several rainforests and lists of rare, endangered or vulnerable species have been changed by this revision. *P.occultus* is recognised as the first reptile species endemic to rainforests of the McIlwraith Ra., FNEQ; *S. cornutus* is no longer a wide-ranging species, but is confined to the Wet Tropics, NEQ; and *P. isis, P. nepthys, P. ossa* spp. nov. and *P. caudiannulatus* join lists of very narrowly endemic rainforest species. □ *Saltuarius, Phyllurus , rainforest, endemism, Reptilia, Squamata,Gekkonidae, Australia.*

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Leaf-tailed geckos are well known as being strongly associated with tropical and subtropical rainforests and, to a lesser extent, heaths on sandstones and granites in eastern Australia. Covacevich, 1975 completed a revision of *Phyllurus*, recognising *Phyllurus platurus* (Shaw, 1790), *P. caudiannulatus* Covacevich, 1975 (both small species); *P. cornutus* Ogilby, 1892, and *P. salebrosus* Covacevich, 1975 (both large species). Since then, additional work has been undertaken on *Phyllurus* species, notably by Wells & Wellington (1985) and by Bauer (1990). Further, many new specimens of *Phyllurus* have been added to the reference holdings of the Queensland and Australian Museums. Wells & Wellington (1985) separated *P. swaini* from *P. cornutus*, recognising the specific status of southern and northern forms, previously treated as one species Covacevich (1975). Bauer (1990) confirmed the monophyly of *Phyllurus*, clarified relationships with other carphodactyline geckos, and provided new data on two distinct subgroups within *Phyllurus,* a new key, and new species diagnoses. He did not recognise *P. swaini*.

Rainforest vertebrates in Australia are now generally regarded as being fairly well known, at least in taxonomic terms. However, rainforests of mideastern Queensland are not as well known as those further north. In an attempt to redress that situation, the National Rainforest Conservation Programme funded research in unsurveyed rainforests in this area. Two of the new species of *Phyllurus* from isolated rainforests of mideastern Queensland were collected during this field work. Their discovery prompted this review.

Some 61 specimens of *Phyllurus* have been added to the Queensland Museum's holdings since Covacevich (1975). Most significant are specimens of a new species from far northern Queensland, three new species from isolated rainforest blocks in mideastern Queensland, and specimens from southern Queensland and New South Wales. The last mentioned confirm recognition of *P. swaini* Wells & Wellington (1985) and provide new distributional records and other data.

Bauer's (1990) definition of two subgroups within *Phyllurus* prompted investigation of possible separate generic status for the large species of *Phyllurus*. In particular, we examined the distribution of the diagnostic characters defined by Bauer in our new specimens and added new information from karyology. As a result, we define a new genus, *Saltuarius*, including four species of large leaf-tails-*S. cornutus* (Ogilby 1892), *S. occultus* sp. nov., *S. salebrosus* (Covacevich, 1975) and *S. swaini* (Wells & Wellington, 1985). To *Phyllurus* sensu stricto we assign two previously recognised species - *P. caudiannulatus*

Covacevich, 1975 and *P. platurus* (Shaw, 1790) and three new species - *P. isis*, *P. nepthys* and *P. ossa* from the rainforests of mideastern Queensland.

Body measurements follow Covacevich (1975) for snout to vent length (SVL); tail length (T), from posterior margin of cloaca to tip of tail; attenuated tip of original tail (TT); head length (HL); head width (HW); snout length (S). Additional measurements include - length of front leg (L1) axilla to tip of longest digit; length of hind leg (L2) groin to tip of longest digit; neck length (NL) axilla to posterior margin of ear.

Morphological characters follow Covacevich (1975) also, with the following modifications - labial scale counts are for both sides of each specimen of newly described species; subdigital lamellae of the 4th toe are for both sides of each specimen (in a sample of 20, 'n' for labial and toe lamellae counts could be a maximum of 40). Skeletal definitions follow Bauer, (1990). Colours are defined subjectively, e.g. cream, rather than according to Ridgway (1912), e.g. cartridge buff. Axillary pits (acarodomatia) are described for both new and previously known species, wherever they are present. As it is not universally agreed that they are useful taxonomic tools (Loveridge, 1951; Arnold, 1986), we use them with caution, only as secondary features, in support of our species definitions.

GENERIC HISTORY

The genus *Phyllurus* has had a fairly stable taxonomic history, save for the successive inclusion in, and exclusion from it of *Underwoodisaurus* spp. *Underwoodisaurus* has been treated as a synonym of *Phyllurus* by Kluge (1967) and Russell (1980), and as distinct from *Phyllurus* by Covacevich (1975) and Bauer (1990). Bauer (1990) provided a 107 character matrix for all carphodactyline taxa and constructed a consensus cladogram of the Australian padless carphodactyline genera from it. His node 5 defined a monophyletic group including *Carphodactylus laevis* with all the then known *Phyllurus* spp. Further, he identified five characters, three of them unique synapomorphies, that confirmed the monophyly of *Phyllurus*. In *Phyllurus*, he recognised two diagnosable subgroups (nodes 7,8). In the former, he placed *P. caudiannulatus* and *P. platurus*. To the latter he referred *P. cornutus* and *P. salebrosus*. This separation of what are essentially the small from the large *Phyllurus* sensu lato, foreshadows the recognition here of a new genus, *Saltuarius*, for the large geckos formerly assigned to *Phyllurus*.

We have examined Bauer's characters for the two phylogenetic divisions in leaf tail geckos (*Phyllurus* sensu lato) in our expanded collection, added new characters and reassessed the evidence using parsimony analysis. One important character, the expansion of the epipubic cartilage, was found to exhibit more variation than recognised by Bauer (1990), with one species of each putative group (*S. occultus* gen. et sp. nov. and *P. nepthys* sp. nov.) having an intermediate condition (Fig. 1). Another significant character used by Bauer was the presence or absence of an anterior process of the interclavicle which, if present, was a narrow spike vs a broad process. Again, we recognize an intermediate state, in *P. nepthys* (Fig. 2).

Important evidence derives from preliminary analysis of karyotypes. Previous studies of *Phyllurus* and related genera of carphodactyline geckos (*Nephurus* and *Carphodactylus*) have reported variation in the number of chromosome arms, but not in the number of chromosomes, all species having the presumed ancestral chromosome number of 2n = 38 (King, 1987). We have obtained new data confirming this result for *S. cornutus* and showing that other species of *Saltaurius* (*S. swaini* and *S. salebrosus*) also have the ancestral condition. Species within *Phyllurus* are unique among carphodactylines in having reduced chromosome numbers. The mideastern Queensland species (*P. caudiannulatus*, *P. nepthys* and *P. ossa*) have 2n = 28 or 2n = 30 chromo-

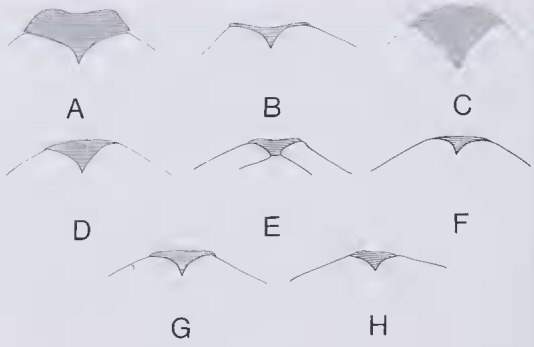

FIG. 1. Variation in size and shape of epipubic cartilage in *Saltuarius* spp. and *Phyllurus* spp. (A) *S. cornutus* - J48178; (B) *S. occultus* - J37037; (C) *S. salebrosus* J33700; (D) *S. swaini* - J8075; (E) *P. caudiannulatus* - J33631; (F) *P. isis* - J53512 (G) *P. nepthys* - J34024; (H) *P. ossa* - J53391. See Bauer (1990) for condition in *P. platurus*.

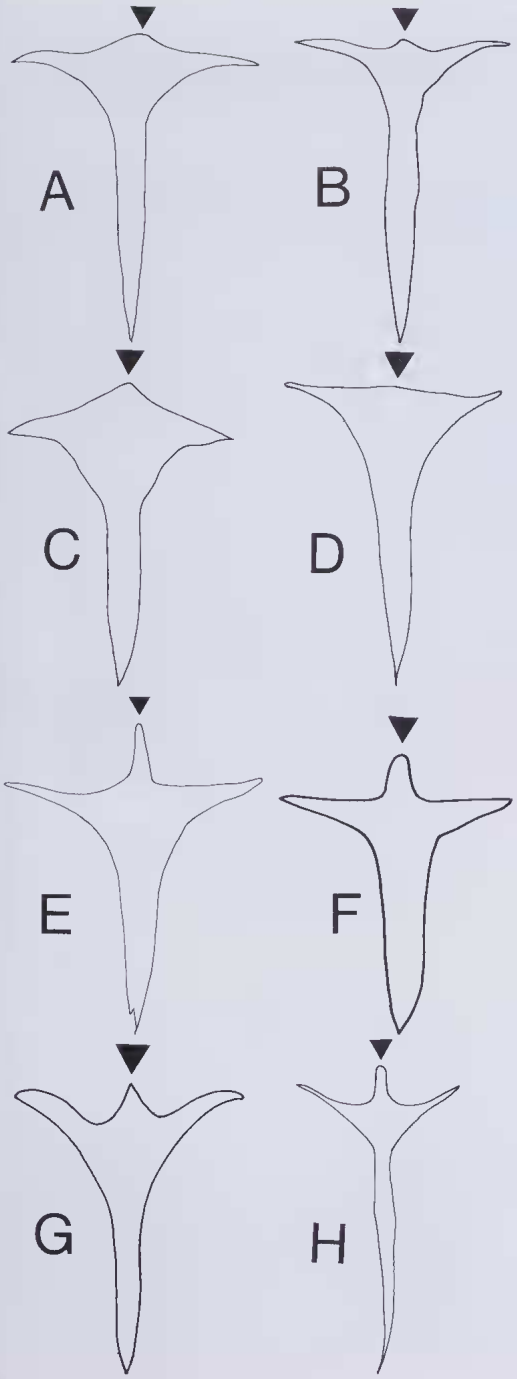

FIG. 2. Condition of the anterior interclavicular extension in *Saltuarius* spp. and *Phyllurus* spp. (A) *S. cornutus* - J48178; (B) *S. occultus* - J37037; (C) *S. salebrosus* - J33700; (D) *S. swaini* - J8075; (E) *P. caudiannulatus* - J33631; (F) *P. isis* - J53512; (G) *P. nepthys* - J34024; (H) *P. ossa* - J53391. See Bauer (1990) for the condition in *P. platurus*.

somes (Fig. 3) with predominantly metacentric or submetacentric chromosomes, suggesting reduction from the 2n = 38 condition via centric fusion. *P. platurus* has an even more reduced chromosome number, 2n = 22. Such dramatic reductions in chromosome number have been reported previously within genera (even 'species' of geckos, e.g. *Nactus*, Moritz, 1987; *Diplodactylus*, King, 1987). Our analysis is limited by small sample size (1-2 specimens per species) and the absence of data for two species, *S. occultus* and *P. isis*. Nonetheless, it provides strong support for the grouping of the species *Phyllurus*.

The chromosome evidence, along with a series of morphological characters (Table 1) were used in a parsimony analysis (using PAUP 3.0s with ordered states and *C. laevis* as an outgroup) to re-evaluate the phylogenetic division proposed within *Phyllurus* sensu lato (Bauer, 1990). Three shortest trees were obtained with the branch and bound search option, and each supported the monophyly of *Saltaurius* and *Phyllurus* (Fig. 4). These major clades were each strongly supported in a bootstrap analysis present in 98% of pseudoreplicates, the former being defined by a minimum of four characters, the latter by six. There was also evidence for grouping of *S. swaini*, *S. cornutus* and *S. salebrosus* to the exclusion of *S. occultus*, although this rests in part on the intermediate state of the epipubic cartilage in *S. occultus*.

The presence of two clearly defined monophyletic lineages within leaf-tailed geckos supports the conclusions of Bauer (1990) and our proposal to recognise *Saltaurius* as a genus.

Saltuarius gen.nov.

See Cogger, et al., 1983; Bauer, 1990.

Referred Species

Saltuarius cornutus (Ogilby, 1892); *S. occultus* sp. nov.; *S. salebrosus* (Covacevich, 1975); *S. swaini* (Wells & Wellington, 1985).

Diagnosis

Nostril in contact with rostral (vs not contacting the rostral in *Phyllurus*); anterior margin of interclavicle flat, or forward projecting without distinct process, Fig. 2a-d (vs bearing a distinct process); axilla not, or only very rarely and shallowly, invaginated (vs always, sometimes deeply invaginated); epipubic cartilage moderate to large, wedge-shaped, Fig. 1a-d (vs small - moderate, wedge-shaped); male preanal pores present, Fig. 5a-e, save for one species, Fig. 5d

TABLE 1: Character matrix on which the phylogeny (Fig. 4) for species of *Phyllurus* and *Saltuarius* gen. nov. is based. This analysis includes only the characters that vary within the leaf-tailed geckos. Monophyly of *Saltuarius* and *Phyllurus* with respect to other carphodactyline geckos was demonstrated by Bauer (1990).

CHARACTERS , 1-15	
salebrosus	002110111111010
swaini	0021?0101111010
occultus	0011??01111?01?
corutus	002110111111010
platurus	210001000000111
isis	2100?100000010?
nepthys	1110?1000000101
ossa	2100?1000000101
caudiannulatus	210001000010101
laevis	010110010100000

CHARACTERS

1.Broadened process on anterior interclavicle extension: 0, narrow splint; 1, intermediate; 2, broad
2.Anterior interclavicle extension: 0, absent; 1, present
3.Epipubic cartilage: 0, not expanded; 1, moderate; 2, greatly expanded
4.Supraocular portion of frontal: 0, flat; 1, furrowed
5.Inscriptional ribs: 0, 0-1; 1, 2-4; 2, 5-7 ribs.
6.Postmental scales: 0, enlarged anteriorly; 1, subequal
7.Scales of rosettes: 0, not spinose; 1, spinose
8.Preanal pores: 0, absent; 1, present
9.Rostral contacting nostril: 0, no contact; 1, contact
10.Body size: 0, max SVL <103mm; 1, max SVL >103mm
11.Rostral: 0, not divided or only partially divided; 1, completely divided
12.Tail: 0, simple; 1, elaborate edge flanges
13.Attenuated tip on regrown tail: 0, not elongate; 1, elongate
14.First autotomy septum: 0, 5; 1, 6
15.Chromosome number: 0, 2n=38; 1,2n<38

(vs male preanal pores absent); original tail[1] strongly flared, with an elaborate outer flange, Fig. 6a (vs cylindrical to simply flared, lacking an elaborate outer flange, Fig. 6b); regenerated tail strongly flared, with only a small attenuated tip (vs cylindrical to moderately flared, with a pronounced attenuated tip). Max SVL 108-144mm, medium to large (vs max SVL 76-103mm[2], small - medium); karyotype 2n=38 (vs 2n=30 or 22); rostral completely divided, Fig.

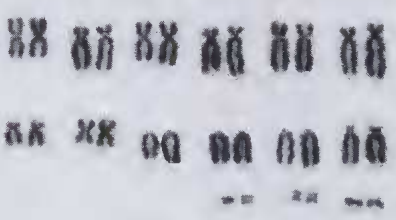

FIG. 3. Karyotype (2n=30) of *Phyllurus nepthys* from Finch Hatton Gorge, MEQ.

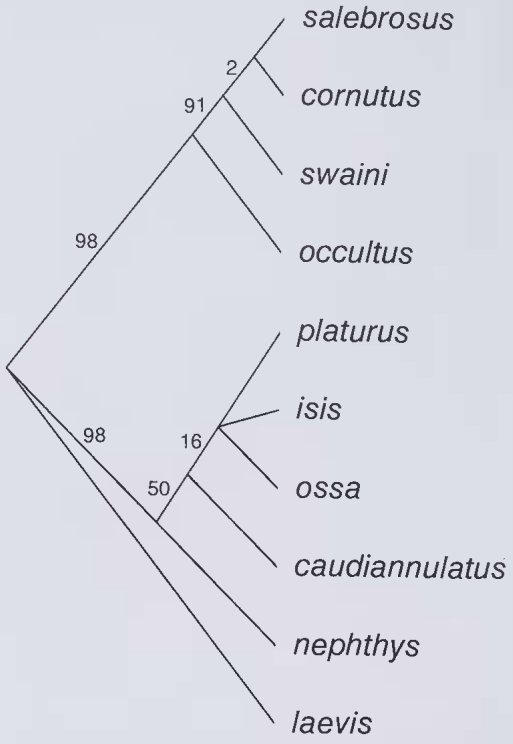

FIG. 4. Phylogenetic hypothesis for species of *Phyllurus* and *Saltuarius* derived from parsimony analysis of morphological characters with ordered character states and 100 bootstrap replicates. The numbers above the branches are the number of replicates in which the group to the right was monophyletic. The analysis provides strong support for the monophyly of species within *Saltuarius* and within *Phyllurus*. The monophyly of the two genera with respect to *Carphylodactylus laevis* is assumed on the basis of Bauer's (1990) analysis.

[1]The original tail of *S. occultus* is not known, because the species is based on only 4 type specimens, none with original tails.
[2] Bauer (1990) gives SVL 112 mm for one *P. caudiannulatus*. The max SVL for *P. caudiannulatus* here is 91.24 mm. Since Bauer's work, *P. nepthys* has been separated from *P. caudianannulatus*. The max. SVL for *P. nepthys* is 103 mm.

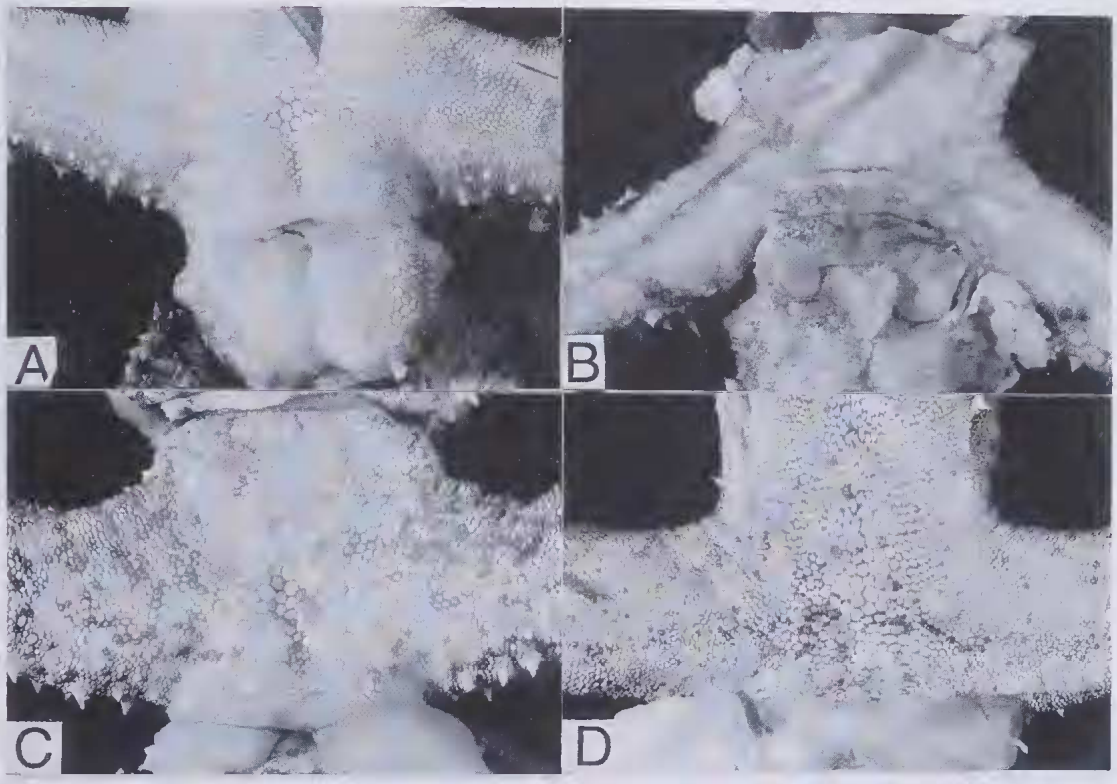

FIG. 5. Presence or absence of preanal pores in *Saltuarius* spp. Preanal pores present (A) *S. cornutus* - J51097, (B) *S. occultus* - J37038, (C) *S. salebrosus* - J33730. Preanal pores absent (D) *S. swaini* - J51639.

7a-d (vs partially divided, Fig. 7e-j, save for one species).

DISTRIBUTION

Eastern Australia: from McIlwraith Ra., Cape York Peninsula, FNEQ, to central coastal NSW (Fig. 8). Individual species accounts contain further details.

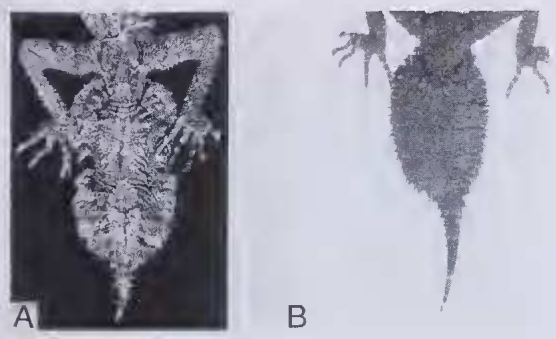

FIG. 6. Original tails of (A) *S. salebrosus* (J33730) - strongly flared with an elaborate outer flange. (B) *P. platurus* (R106497) - simply flared, lacking an elaborate outer flange.

HABITAT

S. occultus and *S. cornutus*, are obligatory rainforest species. *S. salebrosus* occurs in complex notophyll vine forest in Bulburin SF, SEQ, and in araucarian vine thicket in the Goodnight Scrub, SEQ. Throughout the rest of its range, it is found in dry rocky (sandstone) situations. *S. swaini* is found in both rainforest, and in granite-based heathlands.

REPRODUCTION

Oviparous, producing two soft-shelled eggs.

ETYMOLOGY

From the Latin - 'keeper of the forest'.

A key to *Saltuarius*

1.Throat smooth 2
Throat strongly tuberculate..... *S. salebrosus*
2.Lower flank tubercles hooked and surrounded by spinose basal scales (Fig. 9a) ..... *S. cornutus*
Lower flank tubercles not as above 3
3.Neck extremely elongate and slender (Fig. 10a) ..... *S. occultus*
Neck not as above (Fig. 10b) ..... *S. swaini*

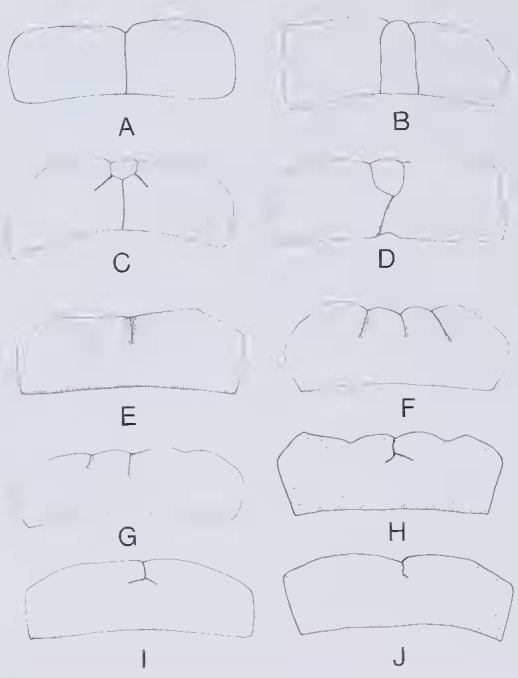

FIG. 7. Variations in rostral grooving (A-D) *S. swaini* (Fig. 7A is the typical condition for all *Saltuarius* spp. and also for *P. caudiannulatus*); (E) *P. isis* (also the condition for *P. nepthys*); (F-H) *P. ossa*; (I-J) *P. platurus*.

Saltuarius cornutus (Ogilby 1892)
(Figs 1a; 5a,d; 7a,b; 9a,b; 11; 12a,b; 13)

Gymnodactylus cornutus Ogilby, 1892.
Phyllurus lichenosus Günther, 1897.
Gymnodactylus spyrurus Barrett, 1950.

MATERIAL EXAMINED
Queensland Museum: J25394, Home Rule (15°44', 145°17') NEQ; J27265, Mt Finlay (15°49', 145°21') NEQ; J51631-2, Bell Pk, Malbon Thompson Ra., (17°05', 145° 52') NEQ; J48279, Danbulla SF, Kauri Ck, Mt Haig Rd (17°07', 145°38'); J25373, Atherton Tableland (17°16', 145°29') NEQ; J9532, Atherton, 11km SW Walsh Camp (17°20',145°25') NEQ; J30991, Boonjee, via Malanda (17°22', 145°45') NEQ; J52775, Millaa Millaa, Palmerston Hwy (17°31', 145°37') NEQ; J48254, Ravenshoe SF, near Vine Ck (17°41', 145°31') NEQ; J48178 (alizarin stained), J48179, Koolmoon Ck, S of Ravenshoe (17°44', 145°34') NEQ; J28355, Koombooloomba Dam, via Tully Falls (17°50', 145°36') NEQ; J51096-7, Paluma SF, 2km from turnoff to Paluma Dam (19°01, 146°12') NEQ; J2126, ?Northern Rivers; J149, Queensland. Australian Museum: R26118-9, Evelyn, approx 14.5km from Ravenshoe (17°30', 145°27') NEQ; R128869, El Arish (17°49', 146°00') NEQ; R12935, Queensland.

The original description of *S. cornutus* is accurate. It has been refined by Covacevich (1975) and Bauer (1990). The former recognised three variable, geographically-isolated forms within *S. cornutus* - from rainforests of NEQ; SEQ-MENSW, and the granite-based heaths of the Stanthorpe area, SEQ. The latter recognised four forms of *S.cornutus* - disjunct populations from near Coen, FNEQ; between Cooktown and Townsville, NEQ; from extreme SEQ to MENSW, and the Stanthorpe area, SEQ. Specimens from far northeastern Queensland were collected in 1979, and referred to *S. cornutus* at registration into the Queensland Museum reference collection. Cogger (1992) included them in his distribution map for *Phyllurus* (now *Saltuarius*) *cornutus* and Covacevich & McDonald (1991a) note their collection locality, McIlwraith Ra. FNEQ (13°50', 143°18'), as the northern limit of the range of *Phyllurus* (=*Saltuarius*) *cornutus*.

The far northeastern Queensland specimens of '*P. cornutus*' (which were not included in any of the descriptions of that species) are here

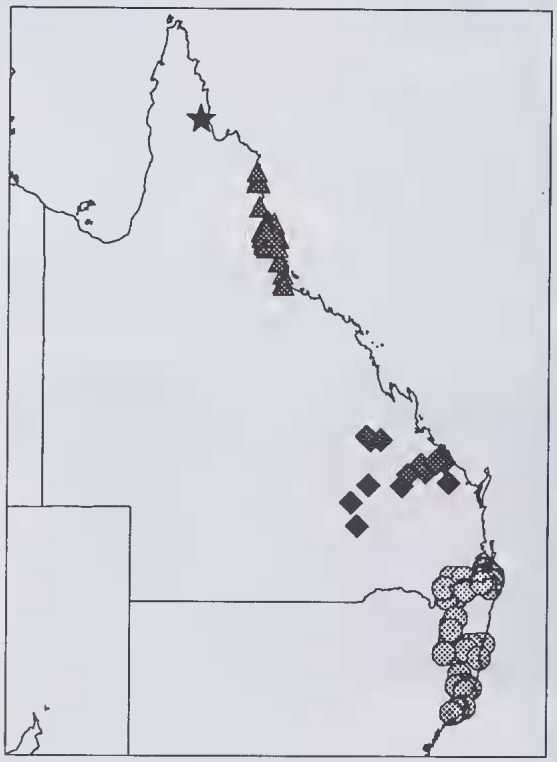

FIG. 8. Distribution of *Saltuarius* spp.

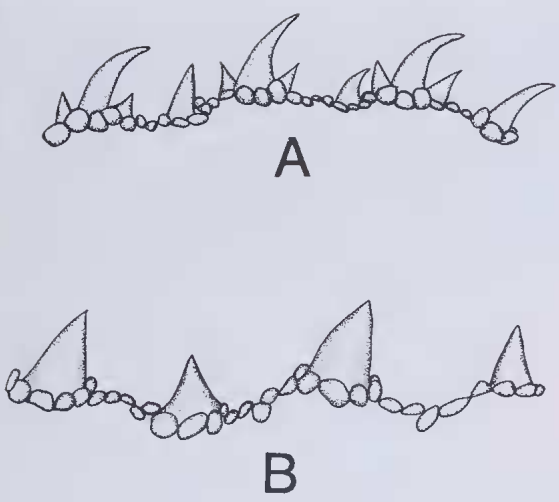

FIG. 9. Flank tubercles of (A) *S. cornutus* (J48254), (B) *S. swaini* (J8183).

described as *S. occultus* . Specimens of '*P. cornutus*' from SEQ- MENSW have been described as *S. swaini* (Wells & Wellington, 1985). The type description is incomplete. It does not include any reference to the features that most readily separate *S. swaini* from *S. cornutus* and does not provide a diagnosis. These, and other deficiencies in the description are redressed under *S. swaini*. The population of '*P. cornutus*' isolated on the Stanthorpe area granites is here referred to *S. swaini*.

With these recent descriptions of new taxa from the wide-ranging former '*P. cornutus*', there are now three species of *Saltuarius* in addition to the nominate species. *S. cornutus* sensu stricto is now confined to the rainforests of the area between Big Tableland and Mt. Spec, NEQ, in the Wet Tropics, one of Australia's World Heritage sites.

Thus, in the light of these changes, data for *S. cornutus* should be modified.

DIAGNOSIS

S. cornutus is a moderately spinose, large *Sal-*

FIG. 10. X-rays showing the cervical vertebrae of (A) *S. occultus* and (B) *S. cornutus*. Elongation of the cervical vertebrae in *S. occultus* results in this species having a proportionately longer neck than other *Saltuarius* spp. Condition (B) is shared with *S. salebrosus* and *S. swaini*.

FIG. 11. *S. cornutus*, Paluma, NEQ (S. Richards).

tuarius (maximum SVL 144mm). It is distinguished from *S. salebrosus* by its chin scalation (smooth, with no raised tubercules vs rough, covered with raised tubercules); from *S. occultus* by flank tubercules (long and hooked - Fig. 9a, surrounded by smaller spines vs not long and hooked and not surrounded by smaller spines), by the number of lumbar vertebrae (2 - Fig. 12a vs 3 - Fig. 12b) and by the size of neck vertebrae (not elongate vs elongate); and from *S. swaini* by flank tubercules (long and hooked, surrounded by smaller spines - Fig. 9a vs not hooked and not surrounded by smaller spines - Fig. 9b). It is further distinguished from *S. swaini* by preanal pores (males with preanal pores - Fig. 5a vs males without preanal pores - Fig. 5d).

DESCRIPTION

With the separation of *S. occultus* and *S. swaini* from *S. cornutus*, the descriptions provided by Covacevich (1975) and Bauer (1990) for this species require minor modification. Bauer (1990) refers to the flank tubercules as being 'enlarged and hooked' (Fig. 9a). We found this character to be confined to NEQ (Big Tableland-Mt Spec) specimens. This character is absent in far NEQ specimens (*S. occultus*) and SEQ through MENSW specimens (*S. swaini*). Bauer's sample (in litt.) was based predominantly on NSW and SEQ specimens from the Australian Museum's collection. This explains why his diagnosis makes no reference to preanal pores, which are present in male *S. cornutus* (Fig. 5a) and absent in male *S. swaini* (Fig. 5d). Covacevich (1975) recognised the difference in the flank tubercules between the NEQ (long hooked spines surrounded by smaller spines - Fig. 9a) and the SEQ-NSW (shorter, unhooked spines - Fig. 9b) populations. At the time she treated this as acceptable variation within a single species. The far NEQ specimens (*S. occultus*) were unknown at the time of her revision. We now regard this feature (long hooked flank tubercules surrounded by smaller spines - Fig. 9a) as key to the diagnosis of *S. cornutus*. Covacevich (1975) and Bauer (1990) provide size ranges for '*P. cornutus*'. Of the three species now recognised from the former *P. cornutus* sensu lato, *S. cornutus* is the largest (maximum SVL 144mm). *S. swaini* has a maximum SVL of 131mm and *S. occultus* (based on the 4 known specimens) has a maximum SVL of 108mm.

The following measurements and characters have not been included in previous descriptions of *S. cornutus*: Proportions as % SVL: L1 43-50 (n18, mean 46.4); L2 53-62 (n17, mean 56.1); S

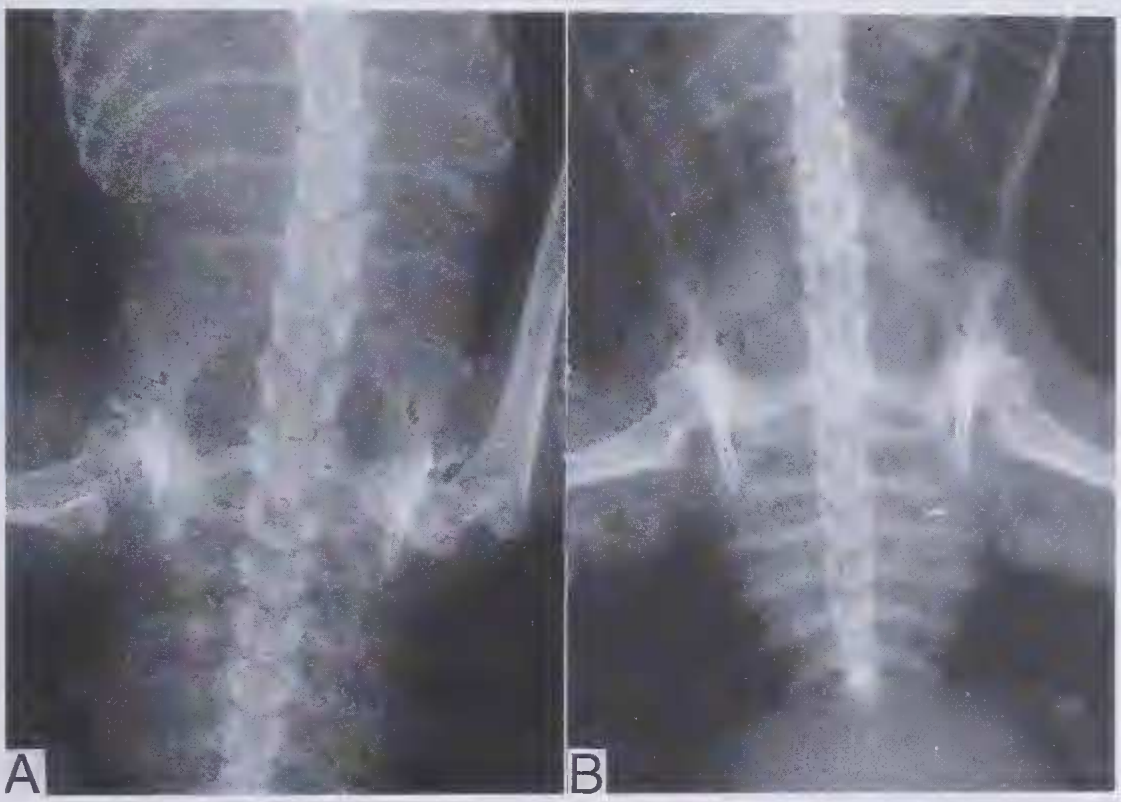

FIG. 12. X-rays showing the number of lumbar vertebrae in (A) *S. cornutus* (J28355), two lumbar vertebrae; (B) *S. occultus* (J37040), three lumbar vertebrae. Condition (A) is shared with *S. salebrosus* and *S. swaini*.

12-15 (n20, mean 13.0); NL 13-21 (n20, mean 17.3). Rostral completely divided by a single vertical groove, Fig. 7a (n18), or by two grooves forming an additional scale and dividing the rostral into three (n2), seen also in *S. swaini*, (Fig. 7b). Axilla not invaginated. Preanal pores present in males (Fig. 5a).

Skeletal Features

Material examined: (X rays) J28355, J30991, J48254; (alizarin stained) J48178.

Supraocular portion of frontal grooved (n4); anterior process of interclavicle projecting slightly forward, Fig. 2a (n1); epipubic cartilage greatly expanded, Fig. 1a (n1); presacral vertebrae 25-26 (n3, mean 25.3); sacral vertebrae 2 (n3); lumbar vertebrae, 2-Fig. 12a (n3); 1st autotomy septum 6 (n1); abdominal vertebrae bearing reduced ribs 4 (n1); rib free cervicals 3 (n3); cervical vertebrae not enlongate; sternal ribs 3 (n1); mesosternal ribs 2 (n1).

Distribution

Big Tableland (15°43', 145°16', sight record, K.McDonald pers. comm.) to Mt Spec (19°01', 146°12') NEQ (Fig. 13). The locality given for QM J212 is '?Northern Rivers', which usually refers to an area in northern NSW. The previous entry in the register (QM J2125) is a specimen of *Nephrurus asper* from the same locality. As neither *S. cornutus* nor *N. asper* occurs in NSW, nor are they sympatric elsewhere, the locality '?Northern Rivers' should probably be regarded as an error.

Habitat

Tree trunks and rocks, tropical rainforest.

Reproduction

A female from the Malbon Thompson Ra., NEQ laid two oval-shaped eggs on 1 December, 1990 (±3 days). These measured 26.62 x 16.05 mm and 27.24 x 16.44 mm. The eggs took 100±3 days to hatch at a temperature of approximately 24°C. Hatchlings measured (SVL) 50.63mm and 51.41mm.

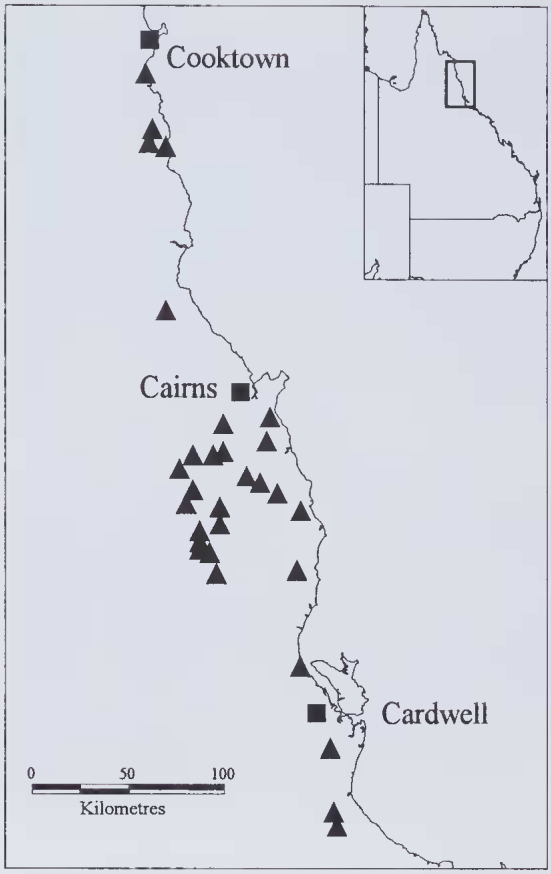

FIG. 13. Distribution of *S. cornutus*.

DIET

A faecal sample from QM J48179 contained fragments of cockroaches, a cricket, and a spider (Blattellidae, Gryllidae and Sparassidae).

Saltuarius occultus sp. nov.
(Figs 1b, 2b, 5a-d, 7a, 10a, 12b, 14, 15)

MATERIAL EXAMINED

HOLOTYPE: Queensland Museum: J37040 ♀ (with regenerated tail) Peach Ck, McIlwraith Ra., 19km ENE of Mt Croll (13°45', 143°19') FNEQ, J.W. Winter, R.G. Atherton, P.A. Matthew, 7 June 1979. PARATYPES: Queensland Museum: J37037 (alizarin preparation), J37038-9 summit of McIlwraith Ra., 17km ENE of Mt Croll (13°46', 143°19'), FNEQ.

DIAGNOSIS

S. occultus is a moderately spinose, medium-sized *Saltuarius* (maximum SVL 108mm). An extremely long, thin neck, a function of elongate neck vertebrae (Fig. 10a), mean % NL/SVL 24.2; a series of enlarged, spinose tubercles fringing the regenerated tail; and three lumbar vertebrae (Fig. 12b) separate it from all its congeners.

S. occultus resembles *S. cornutus* and *S. salebrosus* in having male pre-anal pores (Fig. 5a-c). These are not present in *S. swaini* (Fig. 5d). In *S. occultus* they are very pronounced, and form a raised cluster (vs not pronounced, only just visible without magnification, and flat).

DISTRIBUTION

McIlwraith Ra. (13°45', 143°19'), Cape York Peninsula, FNEQ (Fig. 15).

HABITAT

Microphyll / notophyll vine forests, on a variety of substrates, including granite.

HABITS

Known from only four specimens, all of which were found at night, on granite boulders in rainforest.

REPRODUCTION

The only females known (J37037, J37040) were found with enlarged vitellogenic follicles between late May and early June, 1974.

DIET

The gut of QM J37038 contained spider fragments.

ETYMOLOGY

From the Latin - 'hidden' and so, difficult to find.

DESCRIPTION

SVL (mm): 99-108 (n4, mean 102.7). Proportions as % SVL: L1 45-49 (n4, mean 47.1); L2 56-61 (n4, mean 59.0); HL 25-27 (n4, mean 25.8); HW 16-19 (n4, mean 17.2); S 12-14 (n4, mean 13.0); NL 23-27 (n4, mean 24.2).

Head: large, depressed, elongate, shovel-shaped, distinct from neck; covered in small granules which are intermixed with larger conical tubercles (top of snout without larger tubercles); skin of head and skull not co-ossified; rostral divided, bisected by a deep vertical groove (Fig. 7a); rostral contacting nostril; ear opening extremely narrow, elliptical, vertical, much less than half as large as eye; supralabials 19-21 (n8, mean 19.75), infralabials 18-22 (n8, mean 19.5). Neck: long and slender. Body: moderate, depressed, covered in small granules; dorsal granules intermixed with larger conical tubercles;

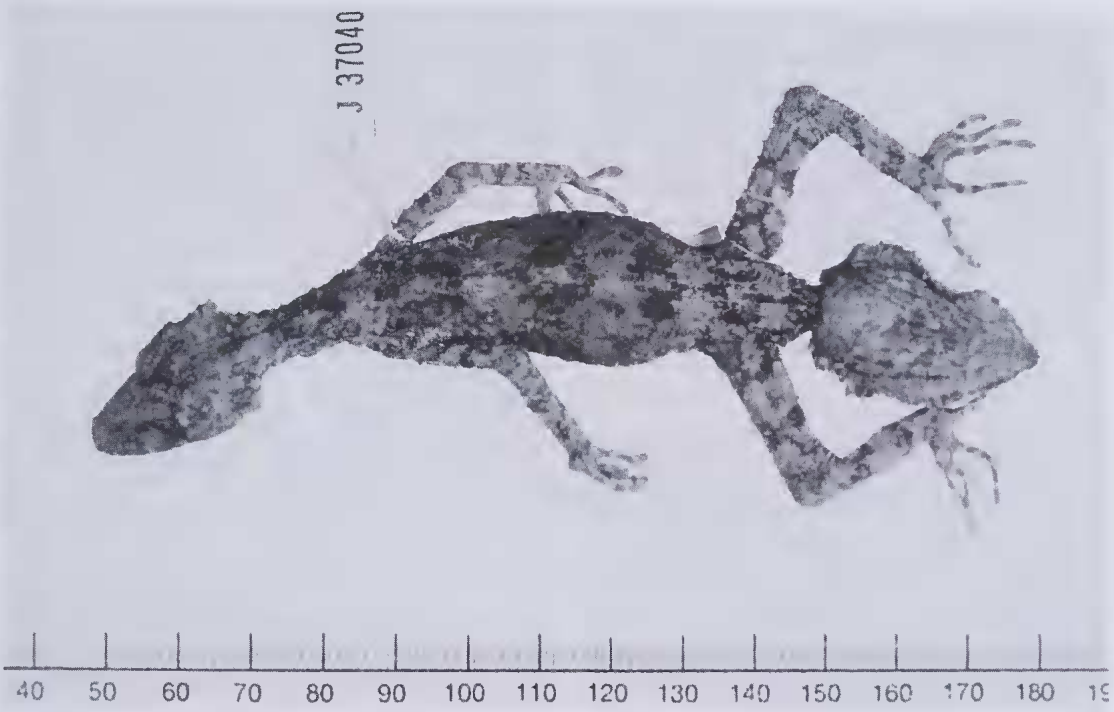

FIG. 14. *S. occultus* (holotype J37040), Peach Ck, McIlwraith Ra., NEQ (B. Cowell).

tubercles moderate on back, small on flanks, no more prominent on sides of neck than back; basal scales surrounding flank tubercles not enlarged; no enlarged tubercles or granules on ventral surface of body. Preanal Pores: present in males, extremely prominent (Fig. 5b). Limbs: long, covered in pointed tubercles dorsally (much more prominent on hind limb); proximal portion of forelimb bearing slightly enlarged tubercules on ventral surface; digits strong, compressed distally; subdigital lamellae (fourth toe) 23-25 (n4, mean 24). Original tail: unknown, because all of the type series have regenerated tails. Regenerated tail: (n4) depressed, broad and leaf-like, contracted at base, not attenuated at tip; lacking spinose tubercles on dorsal surface; edges surrounded by broad spinose tubercles.

Skeletal Features

Material examined: (X rays) J37038-40; (alizarin stained) J37037. Supraocular portion of frontal grooved (n4); anterior process of interclavicle projecting slightly forward (Fig. 2b) n 1; epipubic cartilage slightly expanded (Fig. 1b) n 1; presacral vertebrae 25 (n3); sacral vertebrae 2 (n3); lumbar vertebrae 3 (Fig. 12b) n 3; 1st autotomy septum 6 (n3); abdominal vertebrae bearing reduced ribs 3 (n1); rib free cervicals 3 (n3); cervical vertebrae greatly enlarged (Fig. 10a); sternal ribs 3 (n1); mesosternal ribs 2 (n1).

Pattern

In spirit, dorsal base colour tan; heavily marked

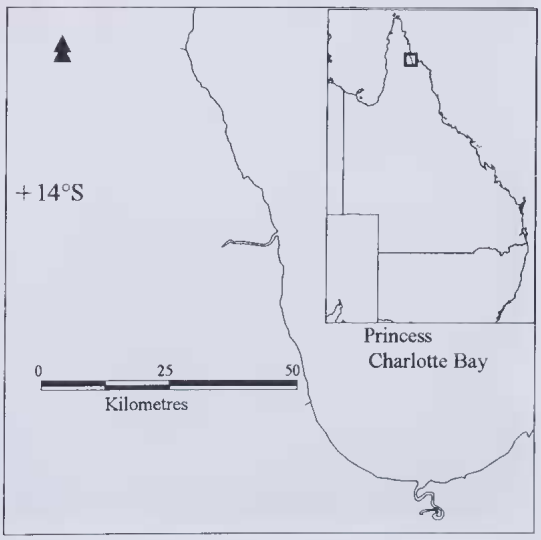

FIG. 15. Distribution of *S. occultus*.

with large distinct, dark brown blotches which form a series of four irregular crossbands between the axilla and groin. Limbs bearing irregular dark brown crossbands. Head marked with less distinct brown blotchings. Ventral surface cream with pale brown mottling on belly, throat and limbs. Labials, mainly dark brown broken by patches of white. Regenerated tail tan to cream, mottled brown dorsally and ventrally.

Saltuarius salebrosus (Covacevich, 1975)
(Figs 7a,b; 16; 17)

MATERIAL EXAMINED

Queensland Museum: J51091-2, Blackdown Tableland, 500m from top (23°46', 149°06') MEQ; J36114, Cania Kroombit goldfield , near Dawes Ra., via Monto (24°38', 150°58') SEQ; J33730-2, Granite Ck. tributary crossing to forestry camp, Bulburin (24°31', 151°29') SEQ; J33700 (alizarin stained), J51090, Bulburin SF (24°31', 151°29') SEQ; J9770, Lowmead (24°32', 151°45') SEQ; J22288, Bulburin SF, Granite Ck, via Many Peaks (24°35', 151°29') SEQ; J8377, Injune (25°51', 148°34') SEQ; J8142, Monto (24°52', 151°07') SEQ; J56919, Bania SF, via Monto (24°57', 150°30') SEQ; J5390, J25360, J28741, Goodnight Scrub, via Wallaville (25°12', 151°55') SEQ; J6198, Burnett R., Goodnight Scrub (25°12', 151°55') SEQ; J28802, J29778, J36115, Robinson Gorge, Taroom (25°17', 149°09'); SEQ; J6382, Cracow, Cracow Ck. (25°18', 150°18') SEQ.

Little that is new can be added to the data on *S. salebrosus*. The type description is accurate and no change to the species definition is warranted following re-examination of the specimens of Covacevich (1975), and examination of those added to muscum collections recently.

The following mcasurements and characters have not been included in previous descriptions of *S. salebrosus*:

Proportions as % SVL: L1 45-50 (n19, mean 47.1); L2 53-61 (n17, mean 57.1); S 11-13 (n20, mean 12.2); NL 15-21 (n20, mean 18.5).

Rostral completely divided by a single vertical groove (Fig. 7a) n 17, or by two grooves forming an additional scale and dividing the rostral into three (n2) seen also in *S. swaini* (Fig. 7b). The axilla is normally not invaginated (n16), but is sometimes slightly invaginated (n4). For skeletal description see Bauer, (1990).

Some modification to distribution of *S. salebrosus* is required following re-examination of

FIG. 16. *S. salebrosus*, Bulburin SF, SEQ (S. Wilson).

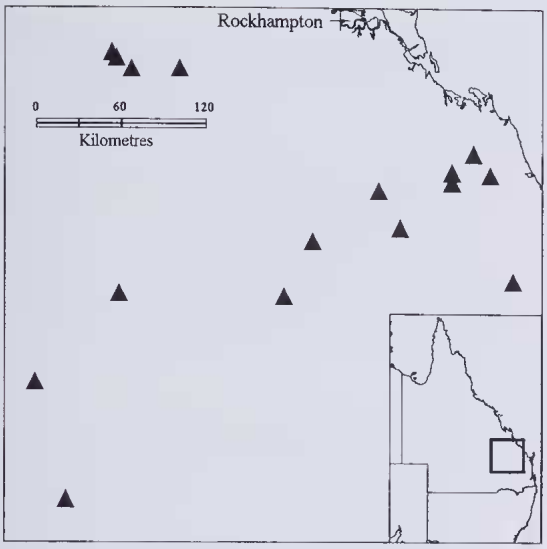

FIG. 17. Distribution of *S. salebrosus*.

data for one specimen originally believed to be from south-central Queensland, remote from the near-coastal range of the species. The record was based on QM J4897 'Coongoola, SCQ'. The specimen in fact comes from Coomboolaroo Station, a locality well within the near-coastal range of *S. salebrosus*, and quite close to the Blackdown Tableland, an area in which *S. salebrosus* is well known now. In addition to restricting the western range of *S. salebrosus*, new data extends it a little to the north and slightly to the south west of its former range, Fig. 17 (minus the 'Coongoola, SCQ' record). New records since those of Covacevich (1975) include Blackdown Tableland, MEQ, J35400, J35448, J51091-2 (23°46', 149°06'), where specimens of *S. salebrosus* are common in heaths on both sandstones and granites, and Bania State Forest, via Monto, SEQ, J56919, (24°57', 150°30') in rainforest.

Reproduction

New data on breeding by *S. salebrosus* are also available. A young specimen (J51090, SVL 52.8mm) was collected at Bulburin State Forest on 18 May, 1991. This individual is similar in size to newly emerged *S. cornutus* hatchlings (50.63-51.41mm). It seems reasonable to regard it as a newly emerged hatchling. The incubation period recorded for *S. cornutus* is approximately 103 days. Because of close taxonomic affinity, it seems reasonable to suggest that the eggs of *S. cornutus* and *S. salebrosus* would have a similar incubation period. If this is so, the oviposition date for hatchling J51091 would have been early February, 1990.

Diet

The gut of QM J33732 from rainforest, contained one large cockroach and a pygmy grasshopper (Tetrigidae). QM J51092 from open forest, contained fragments of a spider.

Saltuarius swaini (Wells & Wellington,1985) (Figs 2d; 5a,d; 7a-d; 9a,b; 18a,b; 19)

Phyllurus swaini Wells & Wellington, 1985.

The specimen chosen as the holotype of *S. swaini* was unfortunate considering the many specimens available to the authors. Specimen AM R116978 (formerly AM Field Series no. 16799), the holotype, is extremely faded and all but patternless; has been totally eviscerated; has a badly damaged left lower jaw; and has a separate, regenerated tail. The type description of *S. swaini*, which is based on this specimen and one published photograph, is neither complete nor accurate. Characters key to separating *S. swaini* from *S. cornutus* are not described (i.e. smaller size, lateral tubercles that are neither hooked nor surrounded by at least some spinose basal scales (Fig. 9b), and the absence of preanal pores (Fig. 5d). Further, part of the discussion of this species is erroneous. ... 'Another species occasionally confused with this taxon is *Phyllurus caudiannulatus* of southeast Queensland; Covacevich, 1975, included northeast New South Wales specimens of *P. swaini* in her analysis of *P. caudiannulatus*' .... *P. caudiannulatus* has not been (and could hardly be) confused with *S. swaini*. The former is very distinct in being considerably smaller than *S. swaini*, and in having a distinctly white-banded original tail. It is restricted to the Dawes/Many Peaks Ranges, SEQ. No mention of specimens from north-eastern New South Wales is made in the description of *P. caudiannulatus* by Covacevich, (1975) although she does refer to *P. platurus* of ...' more open forest in rocky, especially sandstone areas of mideastern New South Wales'...

This re-description of *S. swaini* is based on a sample of specimens selected from the collections of the Queensland and Australian Museums, to give maximum range in terms of distribution and morphological diversity.

Material Examined

Australian Museum R116978, holotype, (formerly AM

Field Series no. 16799) Richmond Ra. SF, (28°31', 152°44') NSW. Other Specimens:Queensland Museum: J398, J2409, J2933-34, J3254, J4439, J8183, J8359, J8861, J10440, J12257, J51095 Mt Tamborine, (27°55', 153°10') SEQ; J4819, Mt Tamborine, Eagle Heights (27°55', 153°12') SEQ; J148 Canungra Ck (27°58', 153°09') SEQ; J3215 Canungra (28°01', 153°11') SEQ; J4198, J5690 Mudgeeraba (28°05', 153°22') SEQ; J5649 Flying Fox Valley, Beechmont (28°08', 153°12') SEQ; J3313 Tallebudgera (28°08', 153°26') SEQ; J5382 Lamington NP (28°12', 153°05') SEQ; J8646 Lamington NP Binna Burra (28°12', 153°11') SEQ J23937 near Mt. Ballow, (28°16', 152°37') SEQ; J51094 Mt. Superbus SF, via Warwick, (28°13', 152°28') SEQ; J51639 J51637-40 O'Reilly's, Lamington NP (28°14', 153°08') SEQ; J8074, J8075 (alizarin stained), J8099 Mt Clunie, via Boonah (28°18', 152°32') SEQ; J1143 Tweed R. (28°18', 153°27') NSW; J5757 Chillingham, Murwillumbah (28°19', 153°17') NSW; J10565 Mt Lindesay (28°23', 152°43') SEQ; J35401 Boonoo Boonoo Falls, via Tenterfield (28°48', 152°10') NSW; J24250, J27349 near Girraween (28°50', 151°55') SEQ; J25374 Girraween NP, via Stanthorpe (28°50', 151°55') SEQ; J28648-9 Girraween area, near Wyberba (28°50', 151°55') SEQ; J29115-7 Stanthorpe area, ?Girraween (28°50', 151°55') SEQ; J30677 Stanthorpe, Aztec Temples, near underground river (28°50', 152°05') SEQ; J51093 edge of Girraween NP (28°50', 151°56') SEQ; J51633-6 Girraween NP, Natural Arch track (28°50', 151°55') SEQ; J54847 Bookookoorara, Boonoo SF (28°51', 152°11') NSW J50345 Girraween NP (28°51', 151°55') SEQ; J30420 near Wyberba (28°52', 151°52') SEQ; J53984 Teapot Ck, Narrow Pass Fire Trail, Mann R. Nature Reserve (29°45', 152°02') NSW; J54846 Bray's Ck, Border Ranges NP (28°24', 153°03') NSW; J9054 Bulahdelah, 96km NE Newcastle (32°25', 152°12') NSW; J56894 found on warehouse wall, Brisbane. Australian Museum: R97823 Mt Superbus,(28°13', 152°26') SEQ; R2409 Murwillumbah, Tweed R., (28°20', 153°24') NSW; R110510 Mt. Warning, (28°24', 153°16') NSW; R118601 Iuonbrook (28°32', 153°21') NSW; R92121-3 6km NW of Amiens, (28°34', 151°46') SEQ; R98332-3 ca. 1.5km NW of Amiens, (28°34', 151°46') SEQ; R130911 Yabbra SF, (28°37', 152°30') NSW; AM Field No. 41650 Black Ck, 6.1km SE along Black Hole Trail, Curramore SF, (29°30', 152°11') NSW; AM Field No. 41770 Willy's Ck, 300m downstream from Oakwood Fire Trail, (29°53', 152°02') NSW; R43870 33km E of Guyra, (30°15', 152°00') NSW; R69866-7, R81921 Coff's Harbour, (30°18', 153°08') NSW; R43875 Dorrigo, (30°20', 152°43') NSW; R43871-3, R16905, R16989, R17008 Pt Lookout, via Armidale, (30°29', 152°25') NSW; R54071 Brinerville, via Thora, (30°29', 152°33') NSW; R97670-2, R106749 Cogger's property, near Brinerville, (30°29', 152°33') NSW; AM Field No. 41683 first falls below Blue Hole, Gara R. Gorge, (30°36', 151°48') NSW; R6284 Gurravembi, near Macksville on Nambucca R., (30°44', 152°59') NSW; R103031 4.5km N. of Wonders Hill Homestead, (31°16', 152°19') NSW; R71372-3 Comboyne Pk, (31°35', 152°32') NSW; R6247 Bulga Tableland, near Bobin, Manning R., (31°37', 152°15') NSW; R6915 Bulong, via Wingham (31°37', 152°18') NSW; R59313 vicinity of Bird Tree, Middle Brother SF, (31°41', 152°42') NSW; R59314 5km W. of highway on Middle Brother Mt (31°41', 152°42') NSW; R43874 Lansdowne, Manning R., (31°47', 152°32') NSW; R8253 Wallis Lake, Tuncurry, (32°17', 152°29') NSW; R101338 O'Sullivan's Gap Forestry Reserve, Buladelah, (32°20', 152°16') NSW; R15412 Girvan, via Stroud, (32°28', 152°04') NSW; R123490 Tullawudjah Ck, (?) NSW.

DIAGNOSIS

S. swaini is a moderately-spinose, large *Saltuarius* (maximum SVL 131mm). It is distinguished from *S. cornutus* by its flank tubercules (tubercules not hooked and not surrounded by smaller spines, Fig. 9b vs tubercules hooked and surrounded by smaller spines, Fig. 9a); from *S. salebrosus* by its chin scalation (chin lacking tubercles vs chin with tubercles); from *S. occultus* by the colour of its labial scales (labials pale, blotched with grey or brown vs labials dark brown with a few patches of white). It is further distinguished from *S. cornutus* by male preanal pores (males without preanal pores, Fig. 5d vs males with preanal pores, Fig. 5a).

DIET

The gut of QM J51640 contained a large cricket (Gryllacrididae).

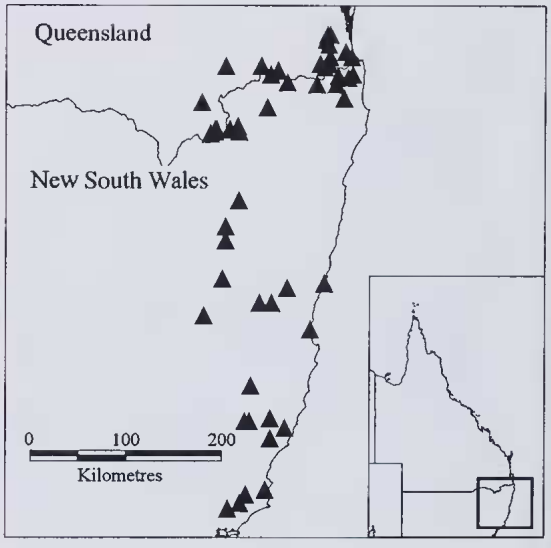

FIG. 18. Distribution of *S. swaini*.

DESCRIPTION

SVL (mm): 41-131 (n101, mean 92.0). Adult SVL (mm): 82-131 (n81, mean 102.6). Proportions as % SVL: L1 37-62 (n83, mean 45.1); L2 50-65 (n81, mean 56.3); T 58-81 (n43, mean 68.1); TT 20-33 (n43, mean 27.8); HL 26-32 (n101, mean 28.1); HW 19-25 (n101, mean 21.5); S 11-14 (n101, mean 12.4); NL 15-23 (n95, mean 19.7).

Head: large, depressed, triangular, distinct from neck; covered in small granules which are intermixed with large rounded to conical tubercles; skin of head co-ossified with skull; rostral completely divided, usually by a single deep groove (n101, for variations see Fig. 7a-d); rostral contacting nostril; ear opening elliptical, vertical, much less than half as large as eye; supralabials 11-20 (n198, mean 14.5); infralabials 9-16 (n192, mean 12.4); Neck: broad; Body: moderate, depressed, covered in small granules; dorsal granules intermixed with larger conical tubercles; tubercles moderate to large on back, flanks and neck; lower flank tubercles small to large, often associated with a lateral flange running from axilla to groin; basal scales surrounding flank tubercles slightly enlarged (Fig. 9b); granules on chest often noticeably larger than adjacent granules. Preanal Pores: Absent (Fig. 5d). Limbs: long, covered in pointed tubercles dorsally; digits strong, compressed distally; subdigital lamellae (fourth toe) 18-26 (n164, mean 21.7). Original tail: (n43) - depressed, broad and contracted at base and attenuated at tip; anterior flared portion surrounded by an undulating flange which bears slender, sharply pointed tubercles around its margin; dorsal surface of tail (except along midline of flared portion) covered in large conical tubercles which are particularly pronounced on the attenuated tip; tubercles extend to tail tip; number of rows of enlarged spinose tubercles across attenuated tip 2-7 (n43, mean 5.3); attenuated tip accounts for 34-45% of total tail length; ventral surface smooth, some specimens with a shallow groove along the midline. Regenerated tail: (n37) depressed, broad and leaf-like, contracted at base and only just attenuated at tip; tail margin is a broad, thin flange which bears minute spinose tubercles around the edges; tail free from spinose tubercles on both dorsal and ventral surfaces; ventral surface without any indication of a shallow groove along the midline.

SKELETAL FEATURES

(X rays)QM J2409, J3313, J4439, J5649, J8359, J28648-9, J51633, J51635-6, J53984; (alizarin stained) J8075, J29115.

Supraocular portion of frontal grooved (n13); anterior process of interclavicle not present, anterior edge flat, Fig. 2d(n2); epipubic cartilage expanded, Fig. 1d (n2); presacral vertebrae 24-25 (n8, mean 24.8); sacral vertebrae 2 (n9); lumbar vertebrae 2 (n7); 1st autotomy septum 6 (n6); abdominal vertebrae bearing reduced ribs 3-4 (n2, mean 3); rib free cervicals 3 (n10); cervical vertebrae not enlongate; sternal ribs 3 (n2); mesosternal ribs 2 (n1).

PATTERN

In spirit, three colour forms are readily distinguished by dorsal colour and pattern - gray to medium brown with both paler and darker blotches in the base colour; these blotches are edged with brown or black lines to give a 'lichen-like' effect (Fig. 19a); often with a pale vertebral streak: gray or mid-dark brown with a pale vertebral streak: heavily blotched with pale gray and black, often with a pale fawn vertebral streak (Fig. 19b). These three forms have cream ventral surfaces, faintly to heavily marked by small clusters of brown scales. Original tails are marked with 'lichen-like' blotches on dorsal surface. Some specimens of the three forms have indistinct light bands across the attenuated tip, sometimes extending to the ventral surface. Ventrally the tails in all three forms are grey to brown, bearing pale blotches and small dark specks. Regenerated tails are pale with cream and brown mottling.

Forms 'lichen-like' (Fig. 19a) and 'gray- mid-dark brown' are the dominant colour morphs in rainforests of southeastern Queensland and New South Wales. Form 'heavily blotched' (Fig. 19b) is dominant in dry eucalypt/granite habitats centred on the Stanthorpe region, SEQ, and the New England Tableland, NSW. However, 'lichen-like' (R98333) and 'gray- mid-dark brown' (R92122) individuals also occur in dry forests near Stanthorpe, and one 'heavily-blotched' individual (R110510) has been collected from rainforest on Mt Warning, NENSW.

Phyllurus Goldfuss, 1820

See Bauer, 1990.

REFERRED SPECIES

Phyllurus caudiannulatus Covacevich, 1975; *P. isis* sp. nov.; *P. nepthys* sp. nov.; *P. ossa* sp. nov.; *P. platurus* (Shaw, 1790).

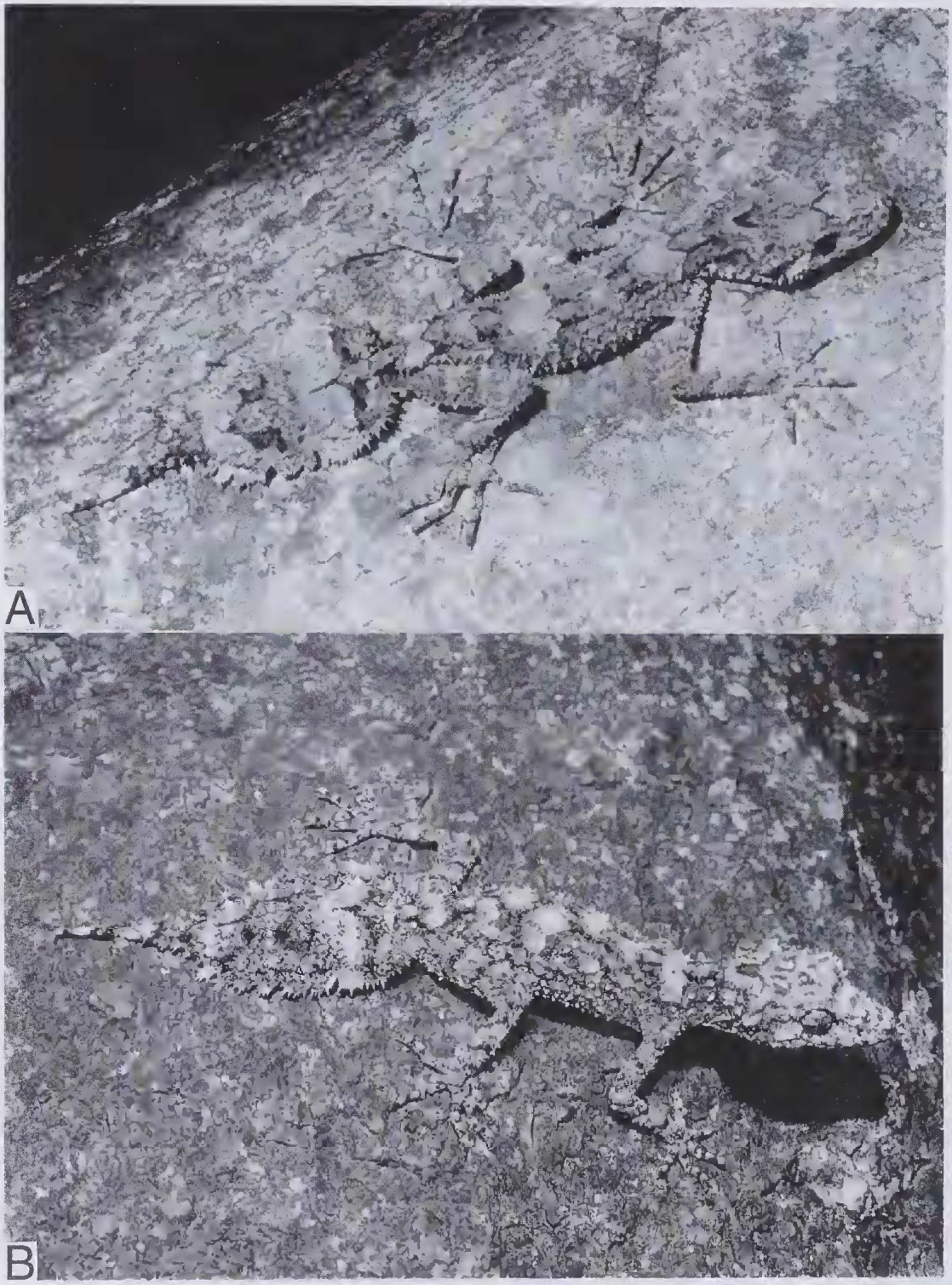

FIG. 19. (A) *S. swaini* (J51094) Mt. Superbus, SEQ (S. Wilson). (B) *S. swaini* Girraween NP, SEQ (S. Wilson.)

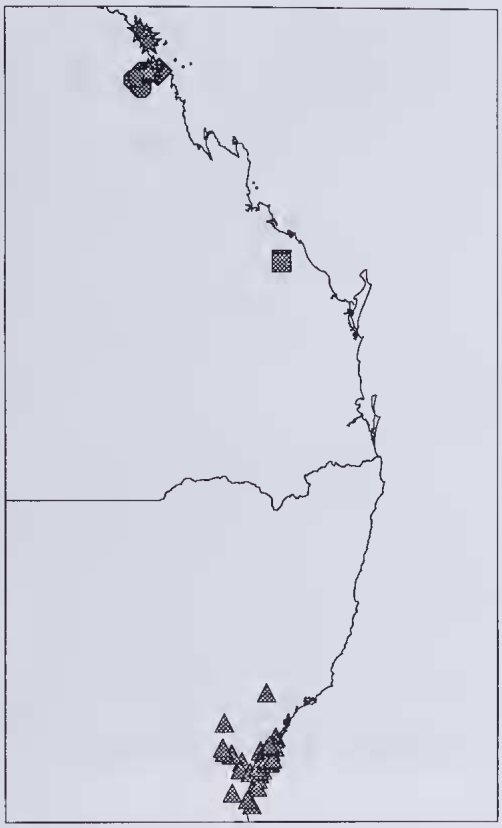

FIG. 20. Distribution of *Phyllurus* spp.

DIAGNOSIS

Nostril not in contact with rostral shield (vs nostril contacts the rostral in *Saltuarius*); anterior margin of the interclavicle with a distinct process, Fig. 2e-h (vs flat or bearing a slight projection, Fig. 2a-d); axilla always, sometimes deeply, invaginated (vs very rarely, invariably shallowly invaginated); epipubic cartilage small - moderate, wedge-shaped, Fig. 1e-h (vs moderate - large, wedge shaped, Fig. 1a-d); male preanal pores absent; original tail cylindrical, without flaring to simply flared, carrot-like (vs strongly flared, with an elaborate spinose outer flange); max SVL 76-103mm, small to medium (vs max SVL 108-144mm, medium to large); karyotype 2n=30 or 22 (vs 2n=38); rostral shield usually partially divided[3], Fig. 7e-j (vs rostral always completely divided, Fig. 7a-d).

DISTRIBUTION

Eastern Australia from the Mackay/ Proserpine district MEQ - to the Sydney district, NSW (Fig. 20).

HABITAT

P. caudiannulatus, *P. isis*, *P. nepthys* and *P. ossa* occur in complex notophyll vine forests on a variety of substrates. *P. platurus* is confined to heaths on sandstones.

REPRODUCTION

Oviparous, producing two soft-shelled eggs.

A KEY TO *PHYLLURUS*

1. Rostral completely divided (Fig. 7a) ..... *P. caudiannulatus*
   Rostral not as above (Fig. 7e-j) 2
2. Venter distinctly 'peppered' with brown... *P. nepthys*
   Venter not as above 3
3. Original tail plain, without light bands..... *P. platurus*
   Original tail not as above (with light bands) 4
4. Rostral with 2-3 partial divisions (Fig. 7f,g) .. *P. ossa*
   Rostral not as above, 1 partial division (Fig. 7e,h). 5
5. Anterior-most white tail marking a broken band .. .. *P. ossa*
   Anterior-most white tail marking two narrowly-spaced, midline blotches ..... *P. isis*

Phyllurus caudiannulatus Covacevich, 1975 (Figs 7a,e; 21; 22)

Phyllurus nepthys Couper et al. 1993. In part.

MATERIAL EXAMINED

Queensland Museum: J15619, Holotype, Bulburin SF, 24km SW Miriam Vale (24°31', 151°29') SEQ; J28356, J33631, J33649, J33651, J33684-5, J33692-5, J33703-4, J33709, J51103-4, as for holotype.
Australian Museum: R47641, R47654, R47657, R47888, R90205, Bulburin SF (24°31', 151°29') SEQ.

The type description of *P. caudiannulatus* is accurate, but requires modification in light of our separation of *P. nepthys* from it. *P. caudiannulatus* was described from Bulburin SF, SEQ. As the description went to press, a specimen (J25411) apparently similar to *P. caudiannulatus*, came to hand from isolated rainforest of the Eungella NP (Clarke Ra.) MEQ, some 480km north of Bulburin. This was referred to *P. caudiannulatus*, despite recognition of certain differences, notably in the tail, between material from Bulburin SF and Eungella NP. Re-examination of specimens of *P. caudiannulatus*, of the Eungella specimen referred to it, and examination of

[3]*P. caudiannualtus* is the exception. It has a completely divided rostral, a character of *Saltuarius* gen.nov.

FIG. 21. *P. caudiannulatus*, Bulburin SF, SEQ (B. Cowell).

additional specimens recently collected from both localities, shows that the differences originally observed are consistent and that there are other distinct characters. Thus, we recognise as distinct *P. nepthys* sp. nov. from the Eungella NP and Crediton SF on the Clarke Ra., MEQ.

DESCRIPTION

Now removed from the series of specimens on which the description of *P. caudiannulatus* was based is QM J25411. *P. caudiannulatus* and *P. nepthys* resemble each other in size, body proportions, colour pattern and spinosity. They differ in the condition of the rostral scale (completely divided in *P. caudiannulatus*, Fig. 7a vs partially divided in *P. nepthys*, Fig. 7e). Further differences are given in the description of *P. nepthys*.

The following measurements and characters have not been included in previous descriptions of *P. caudiannulatus*. Proportions as % SVL: L1 37-45 (n20, mean 42.3); L2 46-54 (n20, mean 50.6); S 11-12 (n20, mean 11.6); NL 17-23 (n19, mean 19.5). Rostral completely divided by a single vertical groove - Fig. 7a (n20). Axilla shallowly to deeply invaginated.

DISTRIBUTION

The range of *P. caudiannulatus* is also restricted with the removal from *P. caudiannulatus* of specimens from the Clarke Ra. *P. caudiannulatus* is now narrowly restricted to rainforests of Bulburin SF, on the Dawes Ra. and Many Peaks Ra., SEQ (Fig. 22). Bauer (1990) notes its occurrence 'to the south and west of Brisbane'. This locality is based on an AMNH specimen from Nerang. Given the SVL (112 mm) of this specimen, it seems reasonable to suggest that it is referable to *S. swaini*, which is known to occur in the Nerang area.

DIET

The gut of QM J33709 contained numerous small beetle fragments, and pieces of a large beetle larva (Coleoptera).

SKELETAL FEATURES

Material examined: (X rays) J28356, J33651, J33684-5, J33693, J33695, J33703-4, J33709; (alizarin stained) J33631. Supraocular portion of frontal flat (n9); anterior process of interclavicle distinct(n1); epipubic cartilage not expanded (n1); presacral vertebrae 26 (n9); sacral vertebrae

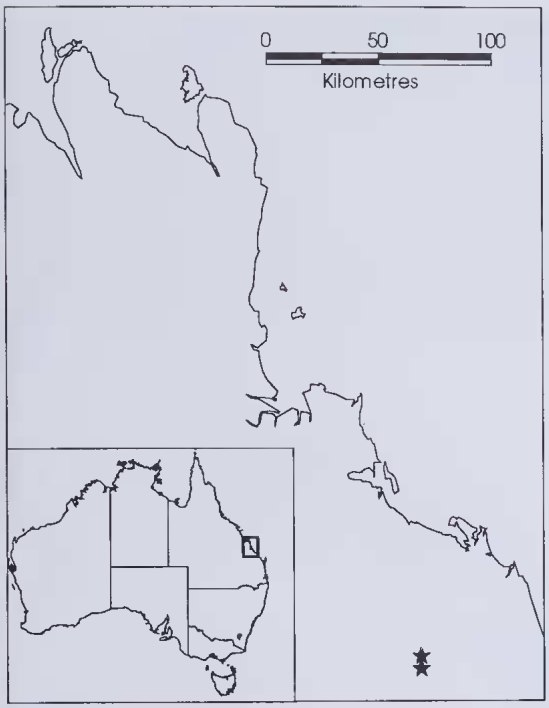

FIG. 22. Distribution of *P. caudiannulatus*.

2 (n9); lumbar vertebrae 2 (n9); 1st autotomy septum 5 (n5); abdominal vertebrae bearing reduced ribs 4 (n1); rib free cervicals 3 (n9); sternal ribs 2 (n1); mesosternal ribs 3 (n1).

Phyllurus isis sp. nov.
(Figs 1f; 2f; 7a,e-h; 23; 24)

MATERIAL EXAMINED
HOLOTYPE: Queensland Museum J 53511 gravid ♀ (with original tail) Mt Blackwood NP (21°02', 148°56'), MEQ, P.J. Couper, J.A. Covacevich, K.R. McDonald, 10 October 1991. PARATYPES: Queensland Museum: J 53485-6; J53518 Coffee Ck, Mt Jukes (21°00' 148°57'), MEQ; J 53480, J53512 (alizarin preparation), J 53591, J53602-3 Mt Blackwood NP (21°02', 148°56'), MEQ.

DIAGNOSIS
P. isis is the least spinose and smallest *Phyllurus* (maximum SVL 76mm). It most resembles *P. ossa*. From *P. ossa* it is distinguished by rostral grooves (a single groove partially dividing the rostral, Fig. 7e vs 2-3 grooves, usually 3, rarely 1, partially dividing the rostral, Fig. 7f-h). It is further distinguished from *P. ossa* by the size of its flank tubercules (small vs moderate). *P. isis* is readily distinguished from *P. caudiannulatus* by the shape of both its original and regrown tail (flared vs cylindrical) and by the nature of the rostral groove (rostral partially divided, Fig. 7e vs rostral fully divided, Fig. 7a); from *P. nepthys* by ventral colour pattern (immaculate vs 'peppered' brown); from *P. platurus* by original tail colour pattern (distinctly banded white vs lacking white bands).

DISTRIBUTION
Mt Blackwood (21°02', 148°56') and Mt Jukes (21°02', 148°57'), Mackay district, MEQ (Fig. 24).

HABITAT
Complex notophyll vine forest, on quartz-syenite and granite.

HABITS
All specimens examined, except QM J53512, were collected during the early evening on rock outcrops. J53512, also active during the early evening, was found sitting on a stick on the forest floor, after light rain.

REPRODUCTION
Gravid females (J53511, J53512, J53602) were present in the population in early October, 1992.

DIET
The gut of QM J53512 contained moth, cockroach and cricket fragments (Lepidoptera, Blattodea; Gryllidae).

ETYMOLOGY
Selected from Egyptian mythology (Mackenzie, 1978). The epithet is to be treated as a noun in apposition.

DESCRIPTION
SVL (mm): 53-76 (n9, mean 69.2). Adult SVL (mm): 68-72 (n8, mean 71.2). Proportions as % SVL: L1 41-45 (n9, mean 42.6); L2 48-56 (n9, mean 52.1); T 73 (n1); TT 40 (n1); HL 28-32 (n9, mean 29.4); HW 22-26 (n9, mean 23.1); S 12-13 (n9, mean 12.2); NL 15-19 (n9, mean 16.8).

Head: large, depressed, triangular, distinct from neck; covered in small granules which are intermixed with larger rounded to conical tubercles; skin of head co-ossified with skull; deep vertical groove partially dividing rostral scale (Fig. 7e); rostral excluded from nostril; ear opening elliptical, vertical, much less than half as large as eye; supralabials 14-18 (n18, mean 15.7); infralabials 13-15 (n18, mean 13.9). Neck: broad. Body:

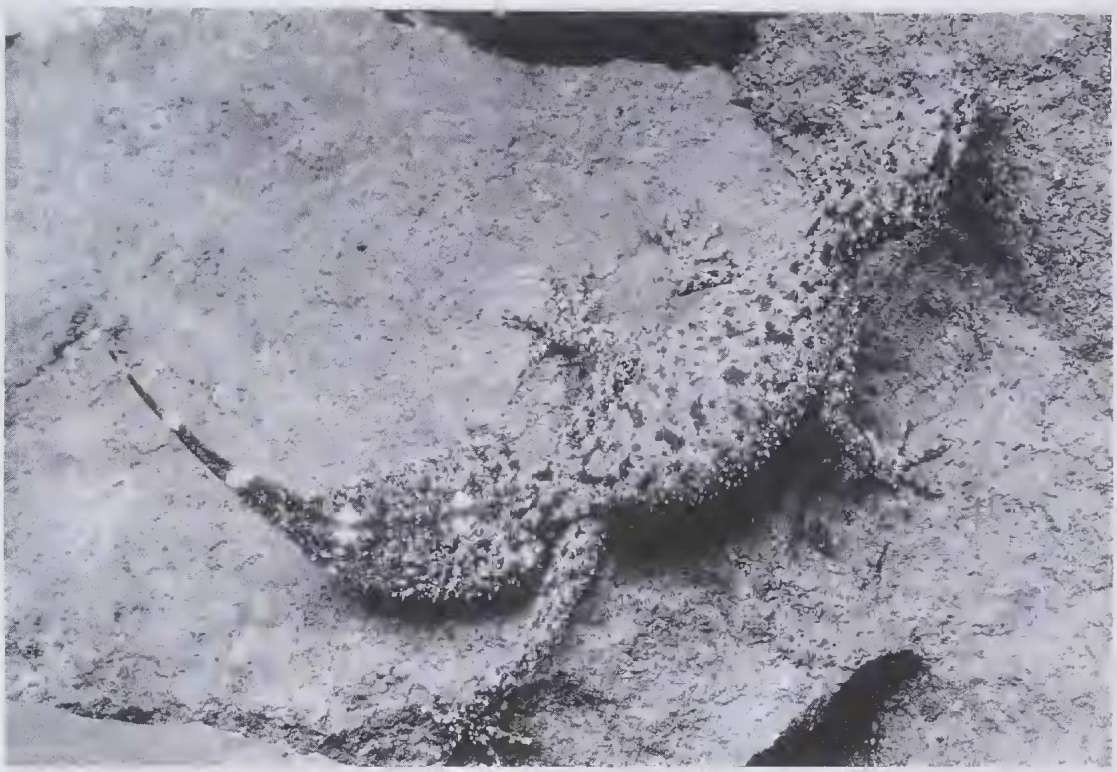

FIG. 23. *P. isis*, Mt Blackwood, MEQ (B. Cowell).

moderate, depressed, covered in small granules; dorsal granules intermixed with larger conical tubercles; tubercles indistinct on back, small on flanks, most prominent on sides of neck; basal scales surrounding flank tubercles not enlarged; no enlarged tubercles or granules on ventral surface of body. Preanal pores: absent. Axilla: Invaginated. Limbs:long, covered in small pointed tubercles dorsally; proximal portion of forclimb bearing enlarged tubercles on ventral surface; digits strong, compressed distally; subdigital lamellae (fourth toe) 18-20 (n9, mean 18.6). Original tail: (n1) depressed, strongly flared, contracted at base and attenuated at tip; without enlarged, spinose edge tubercles; covercd dorsally with numerous minute, spinose tubercles; tubercles terminate approximately half-way along the attenuated tip which is long, fine, and terminates with a minute roundcd 'knob' distally; dorsal tubercles fail to form clearly defined rows anteriorly across the attenuated tip; attenuated tip accounts for 52% of total tail length; ventral surface smooth, deeply grooved along midline (excluding attenuated tip). Regenerated tail: (n6) depressed, flared, contracted at base and attenuated at tip; lacking spinose tubercles on dor-

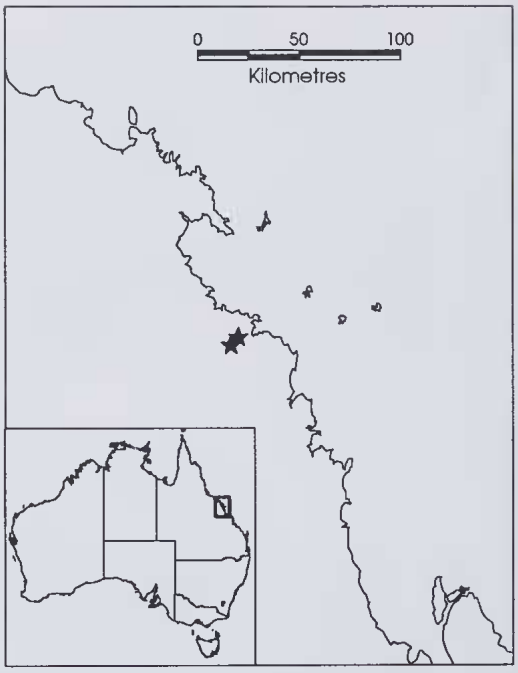

FIG. 24. Distribution of *P. isis*.

sal surface and edges; ventral surface without deep groove along midline.

SKELETAL FEATURES

Material examined: (X rays) J53480, J53485, J53511, J53518, J53591, J53602, J53603; (alizarin stained) J53512.

Supraocular portion of frontal flat (n7); anterior process of interclavicle distinct - Fig. 2f(n1); epipubic cartilage not expanded - Fig. 1f (n1); presacral vertebrae 26 (n7); saeral vertebrae 2 (n7); lumbar vertebrae 2 (n7); 1st autotomy septum 5(n6); abdominal vertebrae bearing reduced ribs 4 (n1); rib free cervicals 3 (n7); sternal ribs 2 (n1); mesosternal ribs 3 (n1).

PATTERN

In spirit, dorsal base colour grey to pale brown; heavily marked with distinct, dark grey to black blotches on head, body and limbs. Body ventrally cream, slightly translucent. Labials pale grey to brown, mottled with white. Original tail dorsally black, indistinctly patterned with irregular grey markings; three distinct creamish bands on attenuated tip, extending to the ventral surface; two broken bands which appear as one irregular blotch on either side of the vertebral line on anterior flared portion; ventrally grey, mottled with white. Regenerated tail totally lacking cream bands; dorsally, grey to brown with obscure creamish blotching; ventrally mottled but paler than dorsal surface.

Phyllurus nepthys sp. nov.

(Figs 1g; 2g; 7a,e,f-h; 25; 26)

Phyllurus caudiannulatus Covacevich, 1975. In part.

MATERIAL EXAMINED

HOLOTYPE: Queensland Museum J34058 ♀ (with original tail) Finch Hatton NP (21°06', 148°38') MEQ, R. Monroe, J.A. Covacevich, P. Filewood, 7-14 April 1975. PARATYPES: Queensland Museum: J50993 Eungella NP, Dalrymple Rd (21°03', 148°34') MEQ; J35128 Thurgood farm, 18km N Dalrymple Hts (21°04', 148°36') MEQ; J34024 (alizarin preparation), J34025, Finch Hatton NP (21°06', 148°38') MEQ; J51098-101 Finch Hatton Gorge (21°06', 148°38') MEQ; J34076-9 Finch Hatton NP (21°06', 148°38') MEQ; J25411 (also a paratype of *P. caudiannulatus*) Broken R. headwaters, Eungella NP (21°08', 148°30') MEQ; J50992 Eungella NP, near Vlasak property (21°10', 148°24') MEQ; J32634-35, J32695 Crediton (21°13', 148°34') MEQ; J32669, J32674-76, J32696, J32733, J32740 Crediton (21°13', 148°34') MEQ; J53330-2 Rocky Dam Ck, via Crediton (21°18', 148°32') MEQ; J53359-62 Rocky Dam Ck, via Crediton (21°19', 148°34') MEQ.

Australian Museum: R47901-14, R47959 Mt William, via Eungella (21°01', 148°36') MEQ; R47512 R47836-49 Eungella (21°08', 148°30') MEQ; R47738-62 Eungella, Dalrymple Hts (21°08', 148°30') MEQ; R47551-6, R47957 Eungella, near Vlasak property (21°10', 148°24') MEQ; R61473 AM building? - no original locality data.

DIAGNOSIS

P. nepthys is an extremely spinose, large *Phyllurus* (maximum SVL 103 mm). A 'peppered' brown venter separates it from all its congeners (with immaculate or mottled venters). *P. nepthys* is further distinguished from *P. caudiannulatus* by its rostral groove (partially divided, Fig. 7e vs completely divided, Fig. 7a); from *P. isis* and *P. platurus* by the depth of its acarodomatia = axillary pits (moderately to deeply invaginated vs shallowly invaginated); and from *P. ossa* by rostral grooves (1 groove partially dividing the rostral, Fig. 7e vs 1-3 grooves, usually 3, only rarely 1 or 2, partially dividing the rostral, Fig. 7f-h).

DISTRIBUTION

Confined to the Clarke Ra., west of Mackay, MEQ. Much of this range is included in the Eungella NP (Fig. 26).

HABITAT

Complex notophyll and mesophyll vine forests on a variety of substrates, including granite.

HABITS

Commonly found in association with both rocks and trees, and also with buildings.

REPRODUCTION

Gravid females (J53332, J53362) were present in the population during late October-late November, 1991.

DIET

The gut of QM J51098 contained a beetle larva (Coleoptera). QM J51099 contained fragments of a fulgoroid leafhopper. QM J51100 contained cockroach and moth fragments (Blattodea and Lepidoptera).

ETYMOLOGY

Selected from Egyptian mythology (Mackenzie, 1978). The epithet is to be treated as a noun in apposition.

FIG. 25. *P. nepthys*, Eungella, MEQ (T. Helden).

DESCRIPTION

SVL - (mm): 39-103 (n98, mean 91.0). Proportions as % SVL: L1 41-49 (n90, mean 43.7); L2 49-60 (n88, mean - 54.3); T 61-89 (n49, mean 75.5); TT 28-50 (n49, mean 40.9); HL 26-31 (n97, mean 27.9); HW 20-24 (n97, mean 21.5); S 9-13 (n97, mean 11.8); NL 14-24 (n96, mean 18.9).

Head: large, depressed, triangular, distinct from neck; covered in small granules which are intermixed with larger conical tubercles (tubercules extremely prominent on snout); skin of head coossified with skull; deep vertical groove partially dividing rostral scale, Fig. 7e; rostral excluded from nostril; ear opening elliptical, vertical, much less than half as large as eye; supralabials 12-20 (n196, mean 15.4); infralabials 10-17 (n195, mean 13.9). Neck: broad. Body: moderate, depressed, covered in small granules; dorsal granules intermixed with larger conical tubercles; tubercles moderate on back, large on flanks and extremely prominent on sides of neck; basal scales surrounding flank tubercles only slightly enlarged; no enlarged tubercles or granules on ventral surface of body. Preanal pores: absent. Axilla: moderately to deeply invaginated. Limbs: long, covered in large pointed tubercles dorsally; without enlarged tubercles on ventral surface; digits strong, compressed distally; subdigital lamellae (fourth toe) 18-24 (n173, mean 20.5). Original tail: (n49) - depressed, flared to carrot-shaped, contracted at base and attenuated at tip; covered with prominent enlarged spinose tubercles over entire dorsal surface; 6-8 rows of enlarged spines across the attenuated portion of the tail; attenuated tip accounts for 45-62% of total tail length; ventral surface smooth, grooved or ungrooved along midline (excluding attenuated tip). Regenerated tail: (n22) depressed, broad and strongly flared, contracted at base and attenuated at tip; covered with spinose tubercles which are most prominent around the edges and on the attenuated tip; ventral surface without groove along midline.

SKELETAL FEATURES

(X rays) QM J32669, J32674-5, J34057, J53331, J53359, J53362; (alizarin stained) J34024. Supraocular portion of frontal flat (n7); anterior process of interclavicle distinct - Fig. 2g;

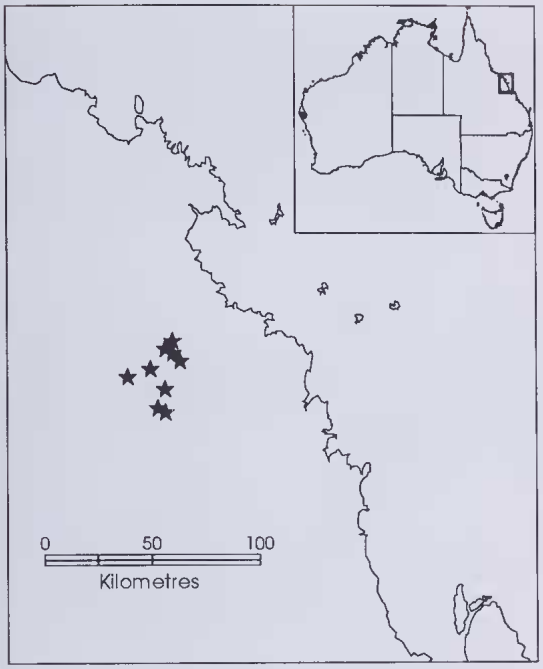

FIG. 26. Distribution of *P. nepthys*.

epipubic cartilage slightly expanded - Fig. 1g; presacral vertebrae 26 (n7); sacral vertebrae 2 (n7); lumbar vertebrae 2 (n7); 1st autotomy septum 5 (n3); abdominal vertebrae bearing reduced ribs 4; rib free cervicals 3 (n7); sternal ribs 2; mesosternal ribs 3.

PATTERN

In spirit, dorsal base colour tan to dark brown; marked with irregular dark brown blotches on head, body and limbs. Body and limbs ventrally cream, faintly to heavily peppered with brown specks; labials cream, mottled with dark brown. Original tail dorsally tan to dark brown, marked with irregular dark brown blotches; four or five bold cream bands on tail, only those on the attenuated portion extending to the ventral surface; some specimens exhibit faint, obscure banding between the bold cream bands; ventrally cream, peppered with brown specks. Regenerated tail totally lacking cream bands; dorsally tan to brown, mottled with cream and dark brown blotches; ventrally mottled but paler than dorsal surface.

Phyllurus ossa sp. nov.
(Figs 1h; 2h; 7a,e,f-h,i,j; 27; 28; 29)

MATERIAL EXAMINED

HOLOTYPE: Queensland Museum: J53444 ♂ (with original tail) Mt Ossa/Ossa Ck, via Mirani (20°56', 148°49') MEQ, P.J. Couper, D. Limpus, M. Cunningham, 20 October 1991. PARATYPES: Queensland Museum: J56775, J56791-2, Vine Ck, Mt Dryander (20°15', 148°33') MEQ; J56766-71, Brandy Ck, Conway Ra. (20°21', 148°41'), MEQ; J56772-4, near Little Conway Mtn, Conway SF (20°27', 148°44'), J53443, J53445-7, J53507 Mt Ossa/Ossa Ck, via Mirani (20°56', 148°49') MEQ; J53426-8 St Helen's Gap, via Mt Charlton (21°00', 148°43') MEQ; J53389-90, J53391 (alizarin preparation), J53392-3, J53414, J56311, Mt Charlton foothills, via Mt Charlton (21°01', 148°44') MEQ.

DIAGNOSIS

P. ossa is a moderately-spinose, medium-sized *Phyllurus* (maximum SVL 89mm). *P. ossa* may be distinguished from *P. caudiannulatus* by its rostral shield (rostral partially divided, Fig. 7f-h vs rostral totally divided, Fig. 7a); from *P. isis*, *P. nepthys*, and *P. platurus* by its rostral grooves (usually 3 grooves, sometimes 2, rarely 1, partially dividing the rostral, Fig. 7f-h vs a single groove partially dividing the rostral, Fig. 7e,i,j). It can be distinguished further from *P. nepthys* by its venter (immaculate vs heavily 'peppered' brown); from *P. platurus* by its original tail (with distinct white bands vs lacking white bands); and from *P. isis* by the size of its flank tubercules (moderate vs small).

DISTRIBUTION

Disjunct populations occur in the Mt Ossa/Mt Charlton area, (21°00', 148°43') north of Mackay, MEQ, in the Conway Ra., (20°27', 148°44') and Mt. Dryander, (20°15', 148° 33'E) via Proserpine, MEQ (Fig. 28).

HABITAT

Complex notophyll vine forest on a variety of substrates.

HABITS

Usually found on rocks in rainforest or on the trunks of trees that are near rock. At Mt Dryander, *P. ossa* was found on large boulders in a dry creek bed. Activity starts soon after dark. This species appears to be common.

REPRODUCTION

Gravid females were present in the population in October, 1992.

DIET

The gut of QM J53391 contained spider fragments. QM J56768 also contained spider fragments, and pieces of a cricket (Gryllidae).

FIG. 27. *P. ossa*, Ossa Ck, MEQ (P. Couper).

ETYMOLOGY

Named for Mt Ossa, the type locality. The epithet is to be treated as a noun in apposition.

DESCRIPTION

SVL (mm): 36-89 (n28, mean 72.9). Adult SVL (mm): 63-89 (n22, mean 78.4). Proportions as % SVL: L1 41-46 (n21, mean 43.2); L2 48-59 (n22, mean 53.6); T 79-93 (n8, mean 86.1); TT 39-53 (n7, mean 48.3); HL 28-32 (n28, mean 29.7); HW 23-26 (n28, mean 24.3); S 11-13 (n28, mean 12.2); NL 14-23 (n28, mean 18.6).

Head: large, depressed, triangular, distinct from neck; covered in small granules which are intermixed with larger conical tubercles; skin of head co-ossified with skull; three deep vertical grooves penetrate dorsal edge of rostral scale (n22), Fig. 7f, two vertical grooves penetrating rostral scale (n5), Fig. 7g; a single inverted 'Y' shaped groove penetrating the rostral scale (n1) (Fig. 7h); rostral excluded from nostril; ear opening elliptical, vertical, much less than half as large as eye; supralabials 13-18 (n56, mean 15.6); infralabials 13-16 (n56, mean 14.3). Neck: broad. Body: moderate, depressed, covered in small dorsal granules intermixed with larger conical tubercles; small on back, moderate on flanks, most prominent on sides of neck; basal scales surrounding flank tubercles slightly enlarged; ventral surface with or without a small patch of enlarged granules on the pectoral region. Preanal pores: absent. Axilla: shallowly to extremely deeply invaginated (Fig.29). Limbs: long, covered in moderate-sized pointed tubercles dorsally; proximal portion of forelimb bearing enlarged tubercles on ventral surface; usually a few enlarged granules on ventral surface of thigh; digits strong, compressed distally; subdigital lamellae (fourth toe) 16-20 (n40, mean18.2). Original tail: (n9) depressed, broad and flared to carrot-shaped, contracted at base and attenuated at tip; with or without an enlarged series of spinose edge tubercles on the anterior flared portion; covered dorsally with numerous moderate-sized, spinose tubercles which become smaller along the vertebral line; tubercles terminate approximately half-way along the attenuated tip which is long, fine and terminates with a minute

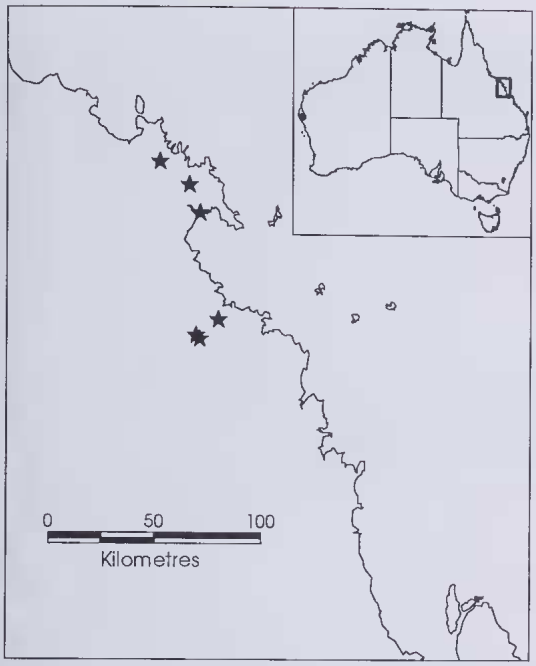

FIG. 28. Distribution of *P. ossa*.

rounded 'knob' distally; dorsal tubercles fail to form clearly defined rows anteriorly across the attenuated tip; attenuated tip accounts for 50-60% of total tail length; ventral surface smooth, lacking a midline longitudinal groove. Regenerated tail: (n17) depressed, broad and flared, contracted at base and attenuated at tip; lacking spinose tubercles on dorsal surface and edges.

Skeletal Features

(X rays) J53390, J53392, J53426-8, J53443-5, J53447, J56766-8, J56770-4; (alizarin stained) J53391. Supraocular portion of frontal flat (n17); anterior process of interclavicle pronounced - Fig. 2h (n1); epipubic cartilage not expanded - Fig. 1h (n1); presacral vertebrae 26 (n17); sacral vertebrae 2 (n17); lumbar vertebrae 2 (n17); 1st autotomy septum 5 (n12); abdominal vertebrae bearing reduced ribs 4 (n1); rib free cervicals 3 (n9); sternal ribs 3 (n1); mesosternal ribs 2 (n1).

Pattern

In spirit, dorsal base colour grey to pale brown; heavily marked with distinct, dark grey to black blotches on head, body and limbs; vertebral zone free from darker blotchings; back with or without obscure pale blotches. Body cream ventrally, slightly translucent. Labials pale grey to brown, mottled with white. Original tail dorsally mid-grey, bearing dark grey blotches; attenuated tip black, with three to four distinct creamish bands which extend to the ventral surface; two prominent broken cream bands across the flared anterior portion of the tail (a faint, very obscure band sometimes lies between these two anterior bands); ventrally cream, faintly to boldly mottled with brown. Regenerated tail totally lacking cream bands; cream to pale grey with obscure black blotching or black with cream or tan blotching; ventrally mottled, but paler than dorsal surface.

Remarks

Populations of *P. ossa* from Conway Ra., MEQ are smaller than the Mt Ossa/Mt Charlton/St Helen's Gap, MEQ populations (adult SVL mm 63-80, n 11, mean 73.7 vs SVL mm 70-89, n 11, mean 83.1). These populations also differ in the depth of their axillary pits. The axilla is extremely deeply invaginated, Fig. 29 (Conway Ra.) vs axilla shallowly invaginated (Mt Ossa/Mt Charlton/St Helen's Gap).

FIG. 29. *P. ossa* from Conway Ra., MEQ, displaying deep axillary pits, acarodomatia (P. Couper).

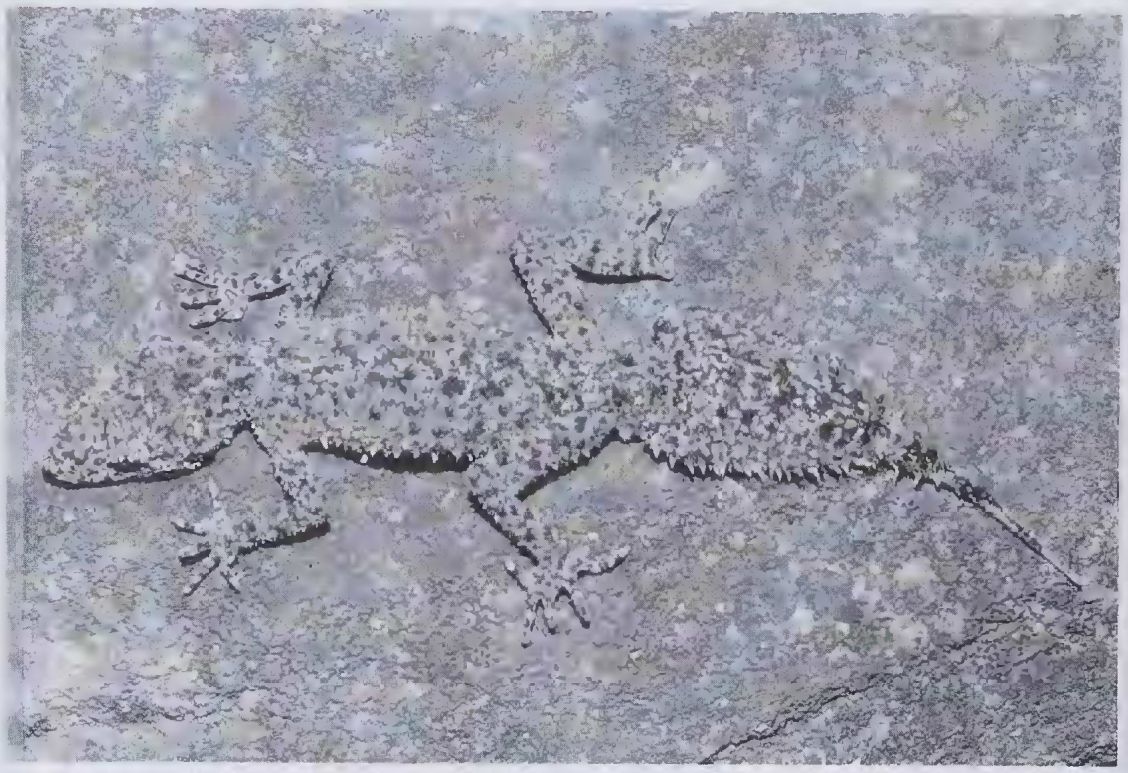

FIG. 30. *P. platurus*, Heathcote, NSW. (S. Wilson).

Phyllurus platurus (Shaw, 1790)
(Figs 7i,j; 30; 31)

See Bauer (1990).

MATERIAL EXAMINED

Queensland Museum: J56880-1, J56895, Marara, via Gosford (33°24', 151°21') MENSW.

Australian Museum: R49185, 28km W, 2km S of Singleton (32°34', 150°51') NSW; R61097, Watagan Ra. (32°57', 151°14') NSW; R55807, Glen Davis (33°08', 150°17') NSW; R106495, Barrenjoey Head (33°35',151°20') NSW; R106609, 10km WNW Mt Ku-ring-gai (33°39',151°02') NSW; R106491, McCarrs Ck, Ku-ring-gai NP (33°40, 151°15') NSW; R107089, Hornsby, Sydney (33°42', 151°06') NSW; R106801, Gordon, Sydney (33°45', 151°09') NSW; R55803, Northbridge, Sydney (33°48', 151°11') NSW; R106497, Dobroyd Head (33°49', 151°16') NSW ; R55808, Heathcote, Sydney (34°05', 151°01) NSW.

The type description, expanded description, and habitat and distribution data of Covacevich (1975) and the rediagnosis of *P. platurus* (Bauer, 1990) need no elaboration.

The following new data on *P. platurus* are based on examination of a sample of 18 specimens from the collections of the Australian and Queensland Museums. QM J9054 from Buladelah, was treated as *P. platurus* by Covacevich (1975), but has been identified as *Saltuarius swaini* here.

REPRODUCTION

Two females from Marara, MENSW each produced a clutch of two oval shaped eggs in late December, 1992. One egg from each clutch was preserved. The second was incubated in vermiculite. The eggs measured 25.03 x 15.85mm, 23.26 x 15.30mm, 20.92 x 15.48mm and 21.83 x 15.28mm. Incubation took 71-72 days at an uncontrolled Brisbane temperature. Hatchlings measured (SVL) 30.28mm and 31.48mm.

DESCRIPTION

The following measurements and characters have not been included in previous descriptions of *P. platurus*. Proportions as % SVL: L1 39-45 (n18, mean 42.9); L2 50-58 (n18, mean 54.0); S 12-14 (n18, mean 13.1); NL 15-21 (n18, mean 18.4).

Rostral only partially divided, by an inverted 'Y' shaped groove, Fig. 7i (n8), by a single verti-

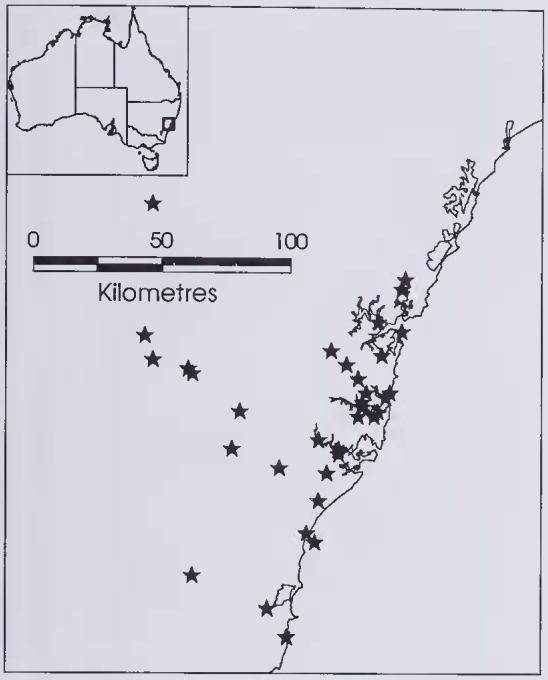

FIG. 31. Distribution of *P. platurus*.

cal line (n8), or by an 'L' shaped groove, Fig. 7j (n2). Axilla shallowly invaginated.

For skeletal details see Bauer, 1990. *P. platurus* stands separate from its congeners in two skeletal features - presacral vertebrae (25 vs 26) and first autotomy septum (6 vs 5).

ZOOGEOGRAPHY

The species of *Saltuarius* and *Phyllurus* are associated with rainforest or heathlands, or both. (*S. occultus* and *S. cornutus* are obligatory rainforest species; *S. salebrosus* and *S. swaini* occur in both rainforests and heathlands. *P. ossa, P. nepthys, P. isis* and *P. caudiannulatus* are obligatory rainforest species; *P. platurus* is a species of heathlands). These associations may reflect the parallel history of the evolution of rainforests and heathlands in Australia. The former evolved on fertile soils, the latter on infertile soils. Each habitat was widely distributed prior the Tertiary (65mya). Tertiary climatic fluctuations account for alternating contractions and fluctuations in their size and for their occurrence as fragmented, coastal and near-coastal narrow strips. Their island-like occurrence in an ocean of sclerophyllous forests is well documented (Kikkawa et al., 1979). With this history of alternating expansion/linking and contraction/separating rainforests and heathlands, it is not surprising that many taxa, some of which have narrow ranges and all of which are endemic to Australia, are 'shared' between rainforest and heathland today.

The recognition of two additional (*S. occultus* and *S. swaini*) species from the formerly very widely distributed *Phyllurus* sensu lato (now *Saltuarius*) *cornutus*, and of three new species of *Phyllurus* (*P. ossa, P. nepthys* and *P. isis*) from a very small area of isolated peaks/ranges in mideastern Queensland is consistent with concepts of separation and isolation of rainforests, and the survival, during such drier periods, of relict patches of rainforest and their faunas. *S. occultus* is a narrowly endemic species, known only from the type series of four specimens, from rainforests of the McIlwraith Ra., FNEQ. Its discovery is interesting zoogeographically. *P. occultus* appears to be one of only five vertebrate species which are confined to the rainforests of Iron-McIlwraith Ranges. (The others are *Antechinus leo* Van Dyck 1980, *Cophixalis crepitans* Zweifel, 1985, *Cophixalis peninsularis* Zweifel, 1985 and *Litoria longirostris* Tyler & Davies, 1977).

The situation where 1/13 rainforest reptile species is endemic to the area (Iron-McIlwraith Ranges) contrasts sharply with that of the rainforest block at the southern part of Cape York Peninsula (the Wet Tropics, between Cooktown, 15°48', 145°15', and Mt. Spec, 18°57', 146°11', NEQ). Here 20/29 rainforest reptile species are endemic. This pattern of Iron-McIlwraith Ranges endemic-species-paucity vs endemic-species-richness in the Wet Tropics is not unique to the reptiles, mammals and frogs. Exact parallels have been observed in heteropodid spiders (V. Davies pers. comm.); land snails (J. Stanisic, pers. comm.); and in carabid and aradid insects (Darlington, 1961; G. Monteith, pers. comm.).

S. cornutus sensu stricto is an addition to the already long list of rainforest reptile species endemic to the Wet Tropics (e.g. Covacevich & McDonald, 1991a,b). This area supports the highest percentage of endemic species known in Australia. A similarly high degree of endemism has been reported also in mammals, birds, frogs, and many invertebrate groups including snails, insects, spiders, crustaceans.

S. salebrosus and *S. swaini* are found in a wide variety of rainforests and heathlands. The former is common from dense, moist, notophyll rainforests to drier semievergreen vine thickets and heathlands, on either granites or sandstones. *S.*

swaini occurs in notophyll rainforests and heathlands. No other vertebrate species share the exact ranges of these two species, although many reptile (and other) species in coastal central and southern Queensland and northern and central New South Wales range between fragments of rainforest and heathland (eg. *Saiphos equalis, Hoplocephalus stephensii, Tropidechis carinatus, Ophioscincus ophioscincus*).

The distribution of *Saltuarius* spp. is paralleled by that of *Antechinus* spp. (Marsupialia: Dasyuridae) with only minor variations. *Antechinus leo* has roughly the same distribution as *Saltuarius occultus*; *A. godmani / S. cornutus; A. flavipes / S. salebrosus; A. stuartii /A. swaini* (S. Van Dyck, pers. comm.).

With the separation of *Saltuarius* from *Phyllurus* sensu lato, *Phyllurus* spp. are confined to the area between mideastern Queensland and mideastern New South Wales. They, too, occur in rainforests (*P. isis, P. nepthys, P. caudiannulatus*) and heathlands (*P. platurus*) and their distributions undoubtedly reflect the parallel evolution of these habitats in eastern Australia. In the Mackay/Proserpine area of mideastern Queensland, three species of *Phyllurus* occur in three localities, all within 100km of each other (Mt Blackwood-Mt Jukes / *P. isis* sp. nov.; Eungella = Clarke Ra./ *P. nepthys* sp. nov.; Mt Charlton, St Helen's Gap, Mt Ossa, Conway / *P. ossa* sp. nov.). Such speciation in a small area appears unusual initially, but can be explained in terms of alternate contraction and expansion of rainforests; the geology of the area; and the probable antiquity of *Phyllurus*. Given the multiple chromosome reduction in these species it is also possible that chromosome changes have contributed to speciation events (Sites & Moritz, 1987).

Rozefelds (1990) has described Oligocene rainforest plant fossils from near Capella, MEQ to the SW of the *Phyllurus* localities. This area is presently extremely dry in comparison with them, and does not now support any vegetation remotely resembling rainforest. He notes of his site '... the area was covered in tropical rainforest communities during the late Oligocene - early Miocene .... the reduction in and/or migration of taxa to refugial rainforest communities along the northeastern Queensland coast can be correlated with the increasing aridity of the Australian climate from the Miocene onwards.... Remnants of Australia's widespread early Tertiary mosaic of rainforest communities are now restricted to *refugia* along the eastern and northern coasts...'. The sequence of the many expansions and contractions of the rainforests has been ably summarised by Archer et al. (1991) who write '... the existence of many now isolated islands of rainforest in Australia is evidence that these ... are remnants of what was once a much wider, more uniformly spread rainforest. Of the islands that remain, those of the tropical and temperate regions are clearly descendants of the ancient, primordial types of rainforest ...'. Genetic studies of reptile species in the Wet Tropics rainforest have revealed major differences attributed to contractions of rainforest in the past (Moritz et al., 1993).

The present species composition of the relict patches of rainforest on Mt Blackwood-Mt Jukes and the occurrence in them of endemic species result from the geological and botanical history of the area. A quartz syenite intrusive (presently Mt Blackwood) formed in the Oligocene (25-40 mya). A second intrusive of granite (presently Mt Jukes) formed, later, but also in the Oligocene. As weathering progressed, the two peaks have been exposed (Champion, 1984). Moist, sheltered pockets have enabled rainforests which have been eliminated from intervening drier areas, to survive. These small islands of rainforest (Mt Jukes-Mt Blackwood, St Helen's Gap-Mt Ossa-Mt Charlton) and the large rainforest islands (Clarke and Conway Ranges) can be viewed as a microcosm of the broader, total present picture of Australia's tropical and subtropical rainforests with their highly endemic, narrowly distributed faunas and floras.

Geckos are poorly known in Australia's fossil record. However, they are present in Oligocene-Miocene deposits (Archer et al., 1991) when rainforest was the dominant vegetation. *Phyllurus* has not been identified from fossil deposits, but Carphodactylini (*Phyllurus*, *Saltuarius* and *Carphodactylus*) which are, today, the only obligatory rainforest geckos in Australia, are regarded as a probable part of the Gondwanic fauna (Covacevich & McDonald, 1991a; Kluge, 1967). An ancestral *Phyllurus* may have occurred widely in the rainforests of the Oligocene-Miocene. Descendants of that ancestral form may have speciated in the 'islands' of rainforest present today.

CONSERVATION STATUS

McDonald et al. 1991 reviewed the conservation status of all Queensland's reptile species. With this review, the following additions to their

list of 'rated' species are necessary - *S. occultus* 2 ('... species with a very restricted distribution in Australia and with a maximum geographic distribution of less than 100km...') K ('... poorly known species ...'); *P. caudiannulatus*, *P. isis, P. nepthys* and *P. ossa* 2R (R, 'species which are rare in Australia .... may be represented by a relatively large population in a relatively restricted area or by smaller populations spread over a wider range ....').

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